Juliana, et al. v. United States of America, et al.

Expert Report of Professor John P. Weyant

August 13, 2018

Contents

PRIVLEGED AND CONFIDENTIAL

I. Qualifications

1. I am a Professor of Management Science and Engineering, Director of the Energy Modeling Forum (EMF), and Deputy Director of the Precourt Energy Efficiency Center at Stanford University. I am also a Senior Fellow of the Precourt Institute for Energy and an affiliated faculty member of the Stanford School of Earth, Energy, and Environmental Sciences, the Stanford Woods Institute for the Environment, and the Freeman Spogli Institute for International Studies at Stanford. My current research focuses on global climate change policy and systems analysis, energy systems analysis, energy technology assessment, and models for strategic planning. I currently serve as honorary co-editor of the journal *Energy Economics* and on the editorial board of the journal *Energy*.

2. I have been a convening lead author or lead author for the Intergovernmental Panel on Climate Change ("IPCC") for chapters on integrated assessment, greenhouse gas mitigation, integrated impacts of climate change, and sustainable development. More recently, I served as a review editor for the climate change mitigation working group of the IPCC's fourth (2003–2006) and fifth assessment (2010–2013) reports. I am a founder and have served as chairman of the Scientific Steering Committee of the Integrated Assessment Modeling Consortium (IAMC)—a collaboration of over 50 global modeling centers from around the world—since its inception in 2007. Over the years I have been active in the United States ("U.S.") debate on climate change policy through the Department of State, the Department of Energy, and the Environmental Protection Agency ("EPA"). In California, I was a member of the California Air Resources Board's Economic and Technology Advancement Advisory Committee (ETAAC), which was charged with making recommendations for technology policies to help implement AB 32, The Global Warming Solutions Act of 2006.

3. I have been awarded the U.S. Association for Energy Economics' 2008 Adelman-Frankel award for unique and innovative contributions to the field of energy economics and the International Association for Energy Economics Outstanding Contributions to the Profession

Award for 2017. I was honored in 2007 as a major contributor to the Nobel Peace Prize awarded to the IPCC and in 2008 by Chair Mary Nichols for contributions to the ETAAC on AB 32.

4. I was asked to provide Congressional testimony on oil security during the 1980s and climate policy during the 1990s and have testified before several California state agencies on climate policy during the 2000s.

5. I earned a B.S. in Aeronautical Engineering and Astronautics, M.S. degrees in Engineering Management and in Operations Research and Statistics all from Rensselaer Polytechnic Institute, and a Ph.D. in Management Science with minors in Economics, Operations Research, and Organization Theory from University of California at Berkeley. After receiving my doctorate, I was a National Science Foundation post-doctoral fellow at Harvard's Kennedy School of Government.

6. My CV, which is attached as Appendix A, summarizes my professional experiences and accomplishments. It also includes a list of my publications, including those in the last 10 years. I have not previously testified in federal or state court. I am being compensated for my time on this matter at an hourly rate of $650. My compensation is not contingent on the outcome of the litigation. I have been assisted in this matter by the staff of Cornerstone Research, who worked under my direction. A list of documents I have relied on for my report is attached as Appendix B.

II. Summary of Allegations and Assignment

7. Plaintiffs, a collection of young adults and youth, allege that the U.S. government, broadly, and specific federal governmental agencies have been aware for decades about the harm of carbon dioxide (CO_2) emissions and the negative effects that unabated CO_2 emissions have on the global climate.[1] Plaintiffs point to a White House report on the environment in 1965 and to

[1] First Amended Complaint for Declaratory and Injunctive Relief, *Kelsey Cascadia Rose Juliana et al., Plaintiffs, v. The United States of America et al., Defendants*, 9/10/2015 ("Complaint"), ¶1 ("For over fifty years, the United States of America has known that carbon dioxide ('CO_2') pollution from burning fossil fuels was causing global warming and dangerous climate change, and that continuing to burn fossil fuels would destabilize the climate system on which present and future generations of our nation depend for their wellbeing and survival.").

the EPA and Congressional Office of Technology Assessment (OTA) reports in 1990 and 1991, respectively, as evidence of the government's historical knowledge of the harms of greenhouse gases ("GHG").[2] This "knowledge," combined with an alleged failure to act to phase out CO_2 emissions (part of the Defendants' conduct at issue) has allegedly resulted in exposing Plaintiffs to hazardous conditions through the mechanism of climate change.[3] The Complaint specifies a list of injuries that each Plaintiff has allegedly incurred because of his or her exposure to human-induced climate change.[4]

8. The Complaint alleges that there is consensus within the scientific community that "[p]resent climate change is a consequence of anthropogenic GHGs, primarily CO_2, derived from the combustion of fossil fuels,"[5] a position to which the federal Defendants agreed in their response to the Complaint.[6] Plaintiffs state that atmospheric CO_2 levels in excess of 350 ppm have created energy imbalances in the global climate and, as part of their claimed remedies, ask the Court to direct the Defendants to take action "to ensure that atmospheric CO_2 is no more concentrated than 350 ppm by 2100."[7]

9. Plaintiffs have submitted multiple expert reports in support of their positions. I was directed to examine aspects of the reports of Dr. Kevin Trenberth and Prof. Steven Running. Counsel for Defendants in this matter asked me to:

a. Evaluate whether the current climate models can tie increases in GHG (primarily CO_2) emissions attributable to Defendants' conduct at issue to the injuries alleged by Plaintiffs. Alternatively posed, can climate models demonstrate that Plaintiffs, living in the various states where they reside (Oregon, Colorado, Louisiana, etc.), suffered the types of climate-related injuries they have claimed because of increased CO_2 emissions attributable to the actions of the Defendants?

---

[2] Complaint, ¶¶2–3.

[3] Complaint, ¶7 ("Yet, rather than implement a rational course of effective action to phase out carbon pollution, Defendants have continued to permit, authorize, and subsidize fossil fuel extraction, development, consumption and exportation – activities producing enormous quantities of CO_2 emissions that have substantially caused or substantially contributed to the increase in the atmospheric concentration of CO_2. Through its policies and practices, the Federal Government bears a higher degree of responsibility than any other individual, entity, or country for exposing Plaintiffs to the present dangerous atmospheric CO_2 concentration.").

[4] Complaint, ¶¶16–92.

[5] Complaint, ¶202.

[6] Federal Defendants' Answer to First Amended Complaint for Declaratory and Injunctive Relief (Defendants' Answer), ¶202.

[7] Complaint, ¶¶12, 203, 257.

b. Estimate what would have happened to atmospheric CO_2 concentrations had the U.S. government curbed U.S. CO_2 emissions in 1990.

III. Overview of Report and Summary of Opinions

10. As is not disputed in this lawsuit, the current scientific consensus is that global temperatures have increased, in part due to anthropogenic reasons (i.e., human-induced causes, where human-induced causes include some unrelated to GHG and some related to GHG, of which some part is related to Defendants' conduct at issue). As is also not disputed in this lawsuit, this increase in global temperatures has resulted in climate change across the planet.[8] I agree with the consensus view, and my report does not dispute this general understanding. Rather, I am addressing the current state of the science of climate change models and their ability to support the localized effects implicit in Plaintiffs' claims of harm (i.e., what injury did they suffer as a result of the Defendants' conduct at issue).

11. My summary opinions in this matter are:

- The reports of Plaintiffs' experts Dr. Trenberth and Prof. Running do not and cannot reliably tie global climate change due to the Defendants' conduct at issue to the claimed injuries they allege affected Plaintiffs where they live, work, or recreate. Their reports do not and cannot distinguish any injuries suffered by Plaintiffs to the specific Defendant conduct at issue (versus other entities, governments, or countries that have substantially contributed to human-induced climate change) because the current state of our scientific understanding is not sufficiently developed. This is because:
    - These climate and climate impact models generally cannot determine the regional effects of global climate change to the degree of specificity necessary to causally link to specific weather events, let alone to individuals and any claimed injuries.
    - A critical challenge is that it is difficult to disentangle the effect of regional climate changes from the effect of other region-specific confounding factors. While the local climate affects the circumstances of outcomes such as crop productivity, coastal damage from storms, frequency of wildfires, injury from heat stress, etc., so do other factors such as local economic growth, migration, urbanization, air and water

[8] Defendants' Answer, ¶202.

pollution, forest and farm management processes, etc. The current set of climate and climate impact models cannot separate these factors with sufficient certainty to disentangle the effect of regional climate changes from the effect of other region-specific confounding factors.

- Thus, the current state of the climate change and climate impact analysis and modeling do not allow one to determine if the specific types and magnitude of injuries to individuals, as asserted by Plaintiffs' experts, are related to something as specific as CO_2 emissions attributable to Defendants' conduct at issue.

- Dr. Trenberth's use of the "conditional" approach that he describes does not remedy the inability of current climate models to determine if Plaintiffs have been injured due to the Defendants' conduct at issue.
- Had the U.S. government been able to stop all U.S. emissions of CO_2 from fossil fuels immediately beginning in 1990—whether from government entities directly or from the U.S. private sector—I predict using a climate model that atmospheric CO_2 concentration in 2015 (when the Complaint was filed) would have been 389 ppm instead of 401 ppm, a 12 ppm difference.

IV. Injury Asserted by Plaintiffs' Expert Dr. Trenberth

12. Dr. Trenberth discusses specific injuries that he claims Plaintiffs experienced as a consequence of human-induced climate change.[9] Exhibit 1 is a summary of the types of climate change impacts Dr. Trenberth has made on behalf of Plaintiffs and the nature of Plaintiffs' alleged injuries. In arriving at his conclusions, Dr. Trenberth discusses two approaches to the climatological science research associated with climate events—one he calls the "conventional" approach, and the other he calls the "conditional" approach.[10] The conventional approach has been the fundamental approach used by scientists and is the basis for IPCC assessments used to inform policymakers on the state of scientific understanding of climate change and its impacts.

13. Dr. Trenberth acknowledges the difficulties of determining if specific weather events are the result of naturally occurring cycles versus the result of human-induced climate change under the conventional approach. After acknowledging these limitations of the conventional approach

[9] Report of Kevin Trenberth ("Trenberth Report"), April 11, 2018, pp. 20–22.
[10] Trenberth Report, pp. 14–16.

to impact assessment, Dr. Trenberth dismisses the conventional approach in favor of a new "conditional" approach:

- "The second kind of attribution study, the conditional approach, relates to the objective of assessing the role of human activities, and especially of human-induced climate change, in the event. Results depend, however, upon how the questions are framed." [11]
- "Because of the infinite variety of weather systems and how rapidly they develop and respond to small perturbations, the atmospheric circulation (dynamics) aspects of climate change are much less predictable than those associated with heat and temperature (thermodynamics). Hence separating out the thermodynamic from dynamic effects in extreme events, i.e., the conditional approach, is a new fruitful way forward in evaluating attribution and results in a different set of questions to be addressed than in the past (prior to 2015)."[12]

14. After introducing the conditional approach, Dr. Trenberth then discusses several examples of extreme climate events before summarizing how various Plaintiffs were affected. What Dr. Trenberth critically does not address is how the weather events Plaintiffs experienced resulted in the injury that he asserts they incurred due to human-induced climate change. To understand why his assertions are unsupported, it is necessary to understand why the conventional approach cannot translate into localized impacts at the scale necessary to know that an individual has been injured by a human-induced changing climate, let alone injured due to the Defendants' conduct at issue. Dr. Trenberth's use of the conditional approach does not remedy these limitations.

A. Dr. Trenberth's Criticisms of the Intergovernmental Panel on Climate Change are Misguided

15. Dr. Trenberth offered several criticisms of the IPCC process:

- "it is a consensus assessment among very disparate scientists from many countries with varying expertise";
- "it is extremely conservative and lags behind the state-of-the-art scientific understanding";

[11] Trenberth Report, p. 15.
[12] Trenberth Report, p. 16.

- "because it is thoroughly reviewed, it is not current at time of publication."[13]

16. Scientists contributing to the IPCC reports arrive at a consensus opinion. Authors who are responsible for various chapters in the report (coordinating lead authors) work with the IPCC leadership to recruit additional lead authors for their chapters, but can also solicit help from other contributing authors who are scientists in specific key areas. Coordinating lead authors have great discretion in deciding who to invite to be contributing authors and in deciding how many of them would be useful in improving the quality of their chapters. These authors work with IPCC leadership and governments to get the best scientific and government reviewers of the work. A large amount of input is obtained from the experts that participate in the IPCC's comprehensive, open, scientific and government review cycles.

17. The process is designed to avoid bias and to avoid drawing strong conclusions from new literature that has not been replicated or thoroughly vetted by the relevant scientific communities. In my opinion, the IPCC process is a detailed but necessary one that serves the purpose that Dr. Trenberth notes: "to provide policy makers with an objective assessment of the scientific and technical information available about climate change, its environmental and socio-economic impacts, and possible response options."[14]

18. In criticizing the timeliness of the information provided by IPCC reports, Dr. Trenberth ignores the flexibility in the IPCC process, afforded by its current rules, to consider the most recent scientific work that is published closer to the time of the issuance of the IPCC's report. Additionally, the IPCC's assessment reports are complemented by (a) IPCC special reports that operate on a faster time table; (b) National Climate Assessment ("NCA") reports done in the U.S. every four years; and (c) analyses from the National Academy of Sciences ("NAS") and other scientific bodies here and abroad to develop science consensus reports to fill in and update the state of the science between IPCC reports.

[13] Trenberth Report, p. 15, footnote 5.
[14] Trenberth Report, p. 15, footnote 5.

B. Dr. Trenberth's Conditional Approach Lacks the Elements to Determine Regional and Sectorial Impacts

19. As noted above, Dr. Trenberth endorses a "conditional" approach for evaluating whether extreme weather events were affected by human-induced climate change. To understand the flaws in Dr. Trenberth's conclusion that Plaintiffs have been injured, it is useful to understand the models for studying climate change's impacts.

20. Scientists have developed a wide range of models of varying degrees of sophistication and resolution used to study climate changes and their impacts on natural and human systems. Three main types of models have been developed and applied in parallel. First, there are comprehensive large-scale earth systems models of the global climate system that have been developed over the last three or four decades. Second, a number of physical and social systems models have been developed to study the impacts of changes in climate and other physical and socioeconomic drivers on physical and economic activity in key sectors and regions of the United States and elsewhere. Finally, in parallel with the other two model types, so-called integrated assessment models have been developed and refined to combine representations of human behavior with simplified representations of the physical earth system to study interactions between the two in more detail. Taken together, these models are focused on measuring and predicting the effects of climate change on natural systems and human systems in specific locations. These models are used to try to draw conclusions about the global climate system changing beyond the annual to decadal cycles in average weather around the world and the role that human activities have played in driving these trends (i.e., the human-induced element of climate change). Results from all three types of models have been used to inform global understanding and decision making regarding global climate change and possible responses to it.

21. The conditional approach is a partial substitute for the first type of model in the conventional approach (i.e., the comprehensive large-scale earth system models). The conditional attribution framework examines the influence of some meteorological measures of extreme climate events, but does not consider the factors included in the second and third types of models. Understanding impacts on physical and social systems—the goal of understanding how human-induced climate change may be affecting people—is not addressed by the conditional approach described by Dr. Trenberth.

22. The physical and social system models (second model type) and integrated assessment models (third model type) examine how we are impacted by the climate event, not simply whether the intensity of the extreme weather event may have been increased by additional GHG emissions. For example, changes in agricultural crop growth, coastal zone damage from hurricanes, heat stress–related illness, and wildfire activity can be affected by global climate change, but they are also impacted by other socioeconomic factors.[15] In the conventional approach, attributing these specific changes to human-induced global climate change is a difficult research task because (1) relating changes in local climate to change in global climatology, including sorting out the global and regional effects of annual and inter-annual variability on the climate system, is complicated science; and (2) the local changes that have been observed may be due to a number of non-meteorological factors (e.g., population growth, urban development, air and water pollution, etc.), as well as changes in local climatology. The conventional approach attempts to understand the attribution "pathways" and has been an important aspect of climate change research. Dr. Trenberth's use of the conditional approach does not eliminate the need to understand these pathways, even if it changes the initial manner in which the climatological influence on local meteorological conditions question is posed.

23. Since the 2001 IPCC report, some of the pathways from increased GHG concentrations to regional changes in climate to changes on physical (e.g., crop growth, ecosystems, and sea levels) and socioeconomic systems (e.g., food prices and farm incomes, coastal zone storm damages) in those regions have been partially identified and measured at least qualitatively, but others remain largely unmeasured and/or unresolved. There are confounding factors that provide alternative explanations for regional and sectoral climate changes, and especially events that may cause negative impacts on people and property. These confounding factors can be other physical and human changes (e.g., population growth, urban development, costal development, forest and agricultural management practices, air and water pollution, etc.) that affect the ability to attribute local impacts to human-induced climate change. Also, any fine-scale projections of climate change impacts have to model the degree of adaptation assumed in past and projected future human behavior. Adaption refers to the process by which people change their behaviors to limit

[15] "Climate Change 2001: Impacts, Adaptation, and Vulnerability," IPCC Third Assessment Report Working Group II Summary for Policy Makers, p. 5, https://www.ipcc.ch/ipccreports/tar/wg2/pdf/WGII_TAR_full_report.pdf.

harmful effects from changing climates. Adaptation has been part of IPCC commentary to policymakers. Policymakers need to consider adaptation when they evaluate policy options relating to climate change.

24. In attributing specific impacts in specific locations on specific individuals, it is necessary to analyze historical data on climate changes and other physical and socioeconomic trends in those specific locations. In the conventional approach, this creates the challenge of running a very high resolution climate model and/or "downscaling" the climatic conditions to the scale where the impacts are most effectively analyzed (e.g., growing regions, water and/or river basins, urban or rural neighborhoods, etc.). However, climate projections at finer scale are less reliable than global averages, and the techniques for downscaling to more specific geographic locations adds additional uncertainty to the calculations. This further adds to the lack of reliability in projections of regional impacts resulting from incremental changes in global GHG emissions.

25. To understand fully how global GHG concentrations contribute to regional impacts, global climate models also need to be integrated with regional/sectoral models and then further integrated with physical and economic impacts that until recently have not generally accounted for other confounding influences that may affect local climate change impacts. These local conditions can include changes in demographics (e.g., population growth, migration, urbanization, forestry management practices) and other environmental stresses (e.g., water, air, and solid waste pollution). I am unaware of efforts to integrate the results of any conditional approaches with local conditions to attribute local impacts to human-induced climate change. By failing to analyze the potential confounding effect of local conditions, Dr. Trenberth reaches conclusions about the impacts on Plaintiffs that are unsupported and therefore unreliable.

C. Unsupported Logical Leap of Dr. Trenberth's Analysis

26. Dr. Trenberth concludes that numerous Plaintiffs have experienced extreme weather events exacerbated by human-induced climate change and that based on where they live they likely will experience more.[16] The analytical support that Dr. Trenberth provides for each

[16] Trenberth Report, p. 23 ("Plaintiffs including Jayden, Levi, Xiuhtezcatl, Victoria, Jaime, Journey, Zealand, and Nathan are already experiencing extreme weather events that have been exacerbated due to anthropogenic climate change. Furthermore, based on the regions where they live, it is my expert opinion that they are likely to experience even greater impacts from extreme weather events in the coming decades.").

Plaintiff varies, but all his conclusions of the injuries to Plaintiffs suffer from the same failure to connect his conditional approach conclusions to Plaintiffs' local circumstances.

27. To illustrate the incompleteness in Dr. Trenberth's analysis, a few examples follow:

a. Dr. Trenberth states: "Plaintiff Jaime from Cameron, AZ, has experienced water shortages related to increasing significant drought, wildfires and heat waves. Wildfires, drought and heatwaves have increased in the area of Jaime's home and reservation because of human-induced climate change."[17] As a case in point, with regard to heat waves, Dr. Trenberth does not address her individual circumstance nor the conditions in Arizona where she lived when experiencing heat waves.[18] Increases in local temperature extremes have been observed in some locations as global mean temperature rises, but how this has caused the incidence of heat stress on local populations may also depend on whether the area has become urbanized, creating what is called an "urban heat island effect" that raises inner city temperatures more than in the surrounding suburban and rural areas. Complicating efforts to measure incidences of heat stress are changing demographics within communities, if, for example, the population becomes more vulnerable (e.g., becomes more weighted to the very young or very old). Further complication results if the population adapts its behavior in response to higher temperatures, including undertaking less rigorous activities during heat waves or times during the day when temperatures peak. Overall, Dr. Trenberth's conclusions are not supported by analysis that allows one to determine how and to what degree Jaime's experiences with water shortages, wildfires, droughts, or heat waves are exacerbated by human-induced climate change. In other words, how were these events different (e.g., more extreme) than in a normal year in arid Arizona? Dr. Trenberth's conclusion about the causes of Plaintiff Jaime's injuries are not based on any analysis of her situation.

[17] Trenberth Report, p. 21.

[18] Dr. Trenberth states that Plaintiff Jaime is from Cameron, Arizona, but the Complaint (¶66) states that she moved to Flagstaff in 2011.

b. Dr. Trenberth states that Plaintiffs Levi from Florida, Journey from Kauai, HI, and Victoria from White Plains, NY, all experienced hurricanes to one degree or another that were magnified in some manner by human-induced climate change.[19] Dr. Trenberth does not address the individual circumstances of the hurricanes that threatened Kauai in 2015, nor in any detail Hurricanes Matthew in 2016 or Irma in 2017 that reached landfall in Florida. He does discuss meteorological aspects of Super Storm Sandy which affected Plaintiff Victoria.[20] Extreme weather events that are localized by their very nature, such as hurricanes, offer another example of the challenges of determining if, or to what extent, coastal zone damage from a hurricane can be attributed to human-induced climate change. Increases in property losses due to hurricanes may result from more intense storms involving higher winds, which may or may not be accompanied with more intense rainfall. Whether flooding and any related property losses occur depends on the topography of where the hurricane makes landfall combined with rainfall amounts and intensity. Property losses from high winds, rain, or flooding may increase simply because there are more people, infrastructure, and economic activity in coastal areas now than there has been historically. Such coastal migration would increase the expected damage from storms even without any climate change–induced changes in the intensity of the storms.[21] Dr. Trenberth concludes "Sandy was undoubtedly larger and stronger as a result of climate change, and the storm surge was much greater owing to high sea levels and strong winds" and that subways in New York would not have flooded without these warming-induced

[19] Trenberth Report, pp. 20–21.

[20] Trenberth Report, p. 18. Dr. Trenberth's discussion includes cost estimates of the storm.

[21] See National Academies of Sciences, Engineering, and Medicine, *Attribution of Extreme Weather Events in the Context of Climate Change* (The National Academies Press, 2016) ("NAS Report 2016"), p. 41. ("The 'extreme' nature of coastal flooding is therefore a product of a combination of different anthropogenic impacts, some of which have little to do with climate-mediated effects like sea level rise."). Adaptive strategies that can affect storm damage and complicate attribution efforts include items such as (a) improved predictions on storm direction providing more advanced warning times to threatened communities; (b) emergency preparedness efforts by individuals, firms, and government agencies; and (c) stricter building code rules and enforcement.

storm effects.[22] Dr. Trenberth fails to analyze (or even discuss) the confounding factors I mention, which renders his attributions conclusory.

c. Dr. Trenberth states: "Plaintiff Journey in Kauai is threatened by extreme storm events. In 2015 an unprecedented number of hurricanes threatened the Hawaiian Islands, again enhanced by human-induced climate change."[23] Dr. Trenberth offered this opinion without explanation for how and the degree to which these storms were "enhanced" by human-induced climate change compared to a year when Kauai would have experienced a typical number of hurricanes.[24]

d. Dr. Trenberth states: "Plaintiff Jacob, Roseburg, Oregon, lives on a farm and enjoys the outdoors. He has become very concerned and influenced by the expanding wildfire season, especially in 2015, when smoke degraded the air quality on many days. The wildfire season has become longer and more intense due to human-induced climate change."[25] Dr. Trenberth's analysis does not address the degree to which the 2015 wildfire season in Oregon was affected by human-induced climate change compared to a normal wildfire season in the area where Plaintiff Jacob lives. Human activity in and near forests is a confounding factor in any analysis of the incidence of wildfire, and Dr. Trenberth is silent on such confounding factors. Importantly, in conjunction with the IPCC's most recent report, the group summarizing the state of scientific understanding for policymakers noted that there was only medium confidence that climate change was a *minor* contributor to increased wildfire activity in western U.S. forests.[26] Specific to Oregon, Exhibit 2 is a chart prepared by the Oregon Department of Forestry ("ODF") for forests in Oregon for which ODF is responsible. The chart

[22] Trenberth Report, p. 18. A *Time* article indicates that age or design likely contributed to the flooding problems that the New York subway experienced in the storm. The Lessons from New York's Flooded Subways, Jeffrey Kluger, *Time*, October 30, 2012.
[23] Trenberth Report, p. 21.
[24] See general discussion of hurricanes at pages 10–14 of the Trenberth Report.
[25] See general discussion of droughts and wildfires at pages 8–9 of the Trenberth Report.
[26] "Climate Change 2014: Impacts Adaptations, and Vulnerability," IPCC, Summary for Policymakers, p. 31 ("Increase in wildfire activity, fire frequency and duration, and burnt area in forests of the western U.S. and boreal forests in Canada, beyond changes due to land use and fire management (medium confidence, minor contribution from climate change)".).

overlays several types of historical data related to wildfire activity. Among the contributing or potentially contributing causes of fire activity, the chart depicts drought years, warm versus cool local climate phases, human-started versus lightning-caused fires, and regulatory and legislative changes involving forest management. Each of these factors is likely relevant in examining the extent of wildfire activity in Oregon. The ODF chart undermines Dr. Trenberth's assertions that 2015 was extraordinary and that the wildfire season has become longer and more intense due to human-induced climate change. At a minimum, Exhibit 2 shows that Dr. Trenberth's claims would require further analysis to be scientifically reliable.

e. Dr. Trenberth states: "Plaintiff Nathan has experienced thawing permafrost and wildfires around his home in Fairbanks, Alaska, especially in 2015. Thawing permafrost is uneven and more likely on sunlight slopes, and has led to tilted and broken buildings and frost heaves in roads. Wildfires were widespread in Alaska in the summer of 2015. These harms are made worse by human-induced climate change."[27] As with his other examples, Dr. Trenberth does not address any confounding factors that might have contributed to the specific weather outcomes in Alaska in 2015, the analysis of which is essential to reach a scientifically valid conclusion about any causal role played by human-induced climate change on Plaintiff Nathan.

V. Limitations of Prof. Running's Analysis

28. Prof. Running concludes that climate change has affected Plaintiffs and impaired their quality of life.[28] See Exhibit 1. He concludes that the inaction of the U.S. government "will serve to penalize future generations of Americans, including the Plaintiffs, for as far into the future as I can imagine."[29] Prof. Running's report, however, does not measure the contribution of the U.S. government, either directly or via policy to change the behavior of the U.S. public, to

[27] Trenberth Report, p. 22.
[28] Report of Steven W. Running (Running Report), April 3, 2018, pp. 3, 9, 13, 14, 17.
[29] Running Report, p. 29.

the climate change trends that his report discusses. Specifically, his report fails to describe, because the science cannot support it, the interaction between these two factors: (a) how to disentangle natural cycles from human-induced climate change at the regional and sectoral level he examined, and (b) what the Defendants' contribution (whether via its direct GHG emissions or a broader definition) is to the ecological impacts he addresses and the alleged injuries to Plaintiffs.

29. When Prof. Running makes claims about injuries to Plaintiffs, he simply presumes that human-induced climate change is the major cause of the multiple hydrological and ecological changes that he discusses, despite the fact that population growth and migration, forest and water management practices, and wildfire and flood prevention measures are also important determinants of the climate events he analyzed. For example, while global warming and less precipitation lead to dryer forests on average, other human activities confound attempts to isolate the impact of climate variables on the area of forest land burned by fires in a given region, unless they are explicitly in the specifications of the model.[30]

A. Extreme Events

30. Identifying the root causes of extreme events, including storms, droughts, and wildfires, can be particularly difficult. A recent compilation report from the NAS of the known science related to these events examined the degree to which they can be attributed to human-induced climate change, noting:

- "Some types of observation-based approaches to event attribution use the historical context in order to determine changes in the rarity of an observed event based on long-term data. For example, this might involve comparing the statistical probability of an event in today's climate to its probability in some previous time several decades earlier when the concentration of anthropogenic greenhouse gases (GHGs) was much lower. In practice, historical observations are often not available for a long enough period to enable a reliable statistical

[30] Studies that consider the role of climate change in increasing fire extent may not be very definitive if, for example, changes in the number of trees resulting from forest management practices, number of people living near forests, number of people visiting forests, and number of forest rangers are all changing simultaneously and those changes are not taken into account.

evaluation of whether there has been a significant change in event frequency or intensity."[31]

- "Droughts, floods, and wildfires, for instance, all have human, as well as natural, components. Land management, controlled burning, and dams and levees impact the magnitude and frequency of these extreme events."[32]
- "Non-meteorological factors can limit the accuracy of model simulations of extreme events and confound observational records. Drought and wildfire are examples of events for which non-meteorological factors can be especially challenging in attribution studies."[33]
- "Event attribution can be further complicated by the existence of other factors that contribute to the severity of impacts. For example, while many studies have linked an increase in wildfires to climate change, the risk of any individual fire depends on past forest management, natural climate variability, human activities in the forest, and possibly other factors, in addition to any exacerbation by human-caused climate change."[34]

B. Human Influence on Wildfires

31. Human activity is a distinct confounding factor in evaluating the causes of wildfires. Humans are frequently responsible for starting fires. The ODF chart (Exhibit 2) shows that human-started fires were more common than lightning-caused fires in each year between 1957 and 2017 in Oregon. It is estimated that across the coterminous U.S. 84 percent of wildfires between 1992 and 2012 were started by people, with distinct regional differences in the proportion of human-initiated fires.[35] This research also notes that, by starting fires *when* they would not start naturally, humans have prolonged the wildfire season outside of the normal summer months.[36] Finally, by starting fires *where* they would not start naturally, humans have

[31] NAS Report 2016, p. 3.
[32] NAS Report 2016, p. x.
[33] NAS Report 2016, p. 7.
[34] NAS Report 2016, pp. 7–10.
[35] Jennifer K. Balch et al., "Human-Started Wildfires Expand the Fire Niche across the United States," Proceedings of the National Academy of Sciences, *PNAS* 114, no. 11 (March 14, 2017) ("Balch et al. (2017)"), pp. 1–2 ("[O]ver 84% of the government-recorded wildfires were started by people from 1992 to 2012. Sixty percent of the total land area of the coterminous United States was dominated by human-started wildfires, whereas only 8% of the area was dominated by lightning fires.").
[36] Balch et al. (2017), p. 2 ("Of all lightning-ignited fires, 78% occurred in the summer (June–August), 9% in the spring (March–May), and 12% in the fall (September–November). In contrast, human-ignited wildfires were more evenly distributed throughout the year, with 24% in summer, 38% in spring, 19% in fall, and 19% in winter.").

expanded the area where wildfires likely occur.[37] Other papers suggest human presence "swamps" the effect of climate on wildfire activity.[38]

32. More people living in and near forests is a confounding factor when evaluating the causes and impacts of wildfires. For example, the population in Oregon nearly doubled between 1969 and 2016, growing from 2.1 million to 4.1 million. Eugene, Oregon, were several Plaintiffs live, grew 77 percent over that same period.[39] Recent research indicates that people are encroaching on forested areas, which complicates firefighting policy and potentially diverts wildfire fighting resources.[40]

33. The management of U.S. forests is another confounding factor when examining the incidence of wildfires. Forestry management practices of fire suppression, combined with other factors, have increased fuel loads in forests, increasing hazards compared to historical norms.[41]

34. In sum, humans are frequently responsible for starting fires, but our impact on the incidence and extent of wildfires is similarly pronounced. These types of complicated interactions are emblematic of the confounding factors that scientists need to consider when examining the influence of climate change. It is the part of the reason why Prof. Running's

---

[37] Balch et al. (2017), p. 3 ("Areas and months of moderate to high human-caused fire density had approximately 40% fewer lightning strikes, and nearly 50% higher fuel moisture levels (based on median values) than for moderate to high lightning-caused fire density.").

[38] Alexandra D. Syphard et al., "Humans Diminish Climatic Influence on Wildfire," Proceedings of the National Academy of Sciences, *PNAS Early Edition*, December 11, 2017, p. 1 ("Climatic variation played a significant role in explaining annual fire activity in some regions, but the relative importance of seasonal temperature or precipitation, in addition to the overall importance of climate, varied substantially depending on geographical context. Human presence was the primary reason that climate explained less fire activity in some regions than in others. That is, where human presence was more prominent, climate was less important. This means that humans may not only influence fire regimes but their presence can actually override, or swamp out, the effect of climate.") See also Michael L. Mann et al., "Incorporating Anthropogenic Influences into Fire Probability Models: Effects of Human Activity and Climate Change on Fire Activity in California," *PLOS One*, April 28, 2016.

[39] Eugene MSA's population rose from 208,936 in 1969 to 369,519 in 2016. "Eugene MSA vs. Oregon, Comparative Trends Analysis: Population Growth and Change, 1969–2016," Oregon Regional Economic Analysis Project, https://oregon.reaproject.org/analysis/comparative-trends-analysis/population/tools/78570000/410000/.

[40] Scott L. Stephens et al., "U.S. Federal Fire and Forest Policy: Emphasizing Resilience in Dry Forests," *Ecosphere*, November 11, 2016 ("Stephens et al. (2016)"), p. 1 ("Current U.S. forest fire policy emphasizes short-term outcomes versus long-term goals. This perspective drives managers to focus on the protection of high-valued resources, whether ecosystem-based or developed infrastructure, at the expense of forest resilience." "Expansion of the wildland–urban interface will continue to drive suppression costs higher; new federal partnerships with States and local governments are needed to address this problem.").

[41] Stephens et al. (2016), p. 6 ("Accordingly, fire suppression response continues to prevail due to a set of decisions and disincentives that heavily favor short-term outcomes. First, it is often most cost-effective in the short-term to contain fire at the smallest reasonable extent but the collective impact of this response over the long-term is to ensure continued fuel accumulation and greater future fire hazard…").

statement that an increased wildfire season due to climate change has and will affect many of the Plaintiffs is an overbroad assertion.[42] Until our scientific understanding is improved and without a more specific examination of Plaintiffs' circumstances, we cannot know.[43] Lastly, Prof. Running makes no effort to address the relative contribution of the Defendants versus other global actors to his opinions.

C. Other Considerations in Attributing Impacts

35. Climate change attributable to GHG emissions is a global phenomenon. Other sources of GHG emissions dwarf emissions from fossil fuels in the United States, let alone GHG emissions of the U.S. government. Prof. Running attributes none of Plaintiffs' injuries to non-U.S. sources of GHG. Not only do other countries generate the majority of GHG emissions, they also do other things that influence outcomes in the United States. For example, Prof. Running discusses the impacts of wildfire smoke on Plaintiffs and notes that Plaintiff Aji of Seattle experienced smoke and ash from a wildfire in 2017, but fails to mention the Canadian influence on that smoke and ash. The news article to which he cites notes that wildfires in Canada were combining with smoke from other U.S. fires to inundate the Pacific Northwest.[44] In this circumstance, events in Canada influenced by regional environmental factors, Canadian forest management practices, and Canadian wildfire fighting policies and resources contributed to the impact on Plaintiff Aji in Seattle.

---

[42] Running Report, p. 13 ("…will impact the many Plaintiffs in the West who suffer increased risk and severity of impacts from wildfires near their homes, in places that they visit for recreation, and in the air they breathe during the extended fire season, including Xiuhtezcatl, Jaime Lynn, Jacob, Sahara, Kelsey, Alex, Zealand, Nick, Aji, Nathan, Hazel and Avery.").

[43] Additionally, the 2014 IPCC assessment report offers only medium scientific confidence that human-induced climate change had a minor contribution to wildfire activity in the western U.S., a conclusion at odds with Prof. Running. This IPCC report also notes low scientific confidence involving a minor contribution from climate change on impacts to North American terrestrial ecosystems involving regional increases in tree mortality and insect infestations in forests—another topic to which Prof. Running attributed a larger impact from human-induced climate change and one he indicated negatively affected several Plaintiffs. See "Climate Change 2014: Impacts Adaptations, and Vulnerability," IPCC, Summary for Policymakers, p. 31; Running Report, pp. 13, 17.

[44] Alan Blinder and Christina Caron, "Seattle Chokes as Wildfire Smoke from Canada Blankets the Northwest," *New York Times*, August 7, 2017, https://www.nytimes.com/2017/08/07/us/wildfires-canada-seattle.html ("Government officials have cautioned people about air quality in a region that is usually known, especially at this time of year, for pristine cobalt skies. But that has not been the case since last week, as the Pacific Northwest has been inundated by plumes of smoke from Canada, where more than 20 wildfires are blazing.... 'There are several fires in the Pacific Northwest that have contributed to the smoke as well,' said Mr. Apfel, who estimated that there were currently about 16 large fires in Washington and Oregon. 'Previous years have had quite a bit of rainfall, and you get a lot of vegetation — and when it dries up, that's what starts burning when the fire starts.'").

VI. Modeling the Effects of a Cessation of U.S. CO_2 Emissions

36. As an additional element of my assignment, I was asked to determine, if possible, what the effects would be on atmospheric CO_2 concentrations had the United States eliminated all fossil fuel CO_2 emissions starting in 1990. In this analysis, I have assumed that the U.S. government as well as all of the U.S. private sector ceased fossil fuel CO_2 emissions beginning in 1990.

37. I examined the change in atmospheric CO_2 concentration from 1990 to 2015 (the date of the Complaint), using the "Model for the Assessment of Greenhouse Gas Induced Climate Change" (MAGICC), a widely used representation of the climate system that links CO_2 emissions to the mean surface temperature on the earth.[45] The IPCC has used MAGICC extensively to predict global mean temperature increase and sea-level rise.[46]

38. I used the most recent version of the model, MAGICC 6, to calculate CO_2 concentrations in the earth's atmosphere under two CO_2 emissions scenarios:[47] (1) a baseline business as usual emissions path, and (2) a 100% emissions reduction scenario where the U.S. completely stops emitting CO_2 from burning fossil fuels from 1990 forward. In the no-emissions case, I find that global CO_2 concentrations would decline by 12 ppm (from 401 to 389) in 2015 relative to the baseline business as usual scenario. Exhibit 3A illustrates the effect of the no-emissions case. Cases predicated on more modest emission reductions assumptions result in smaller effects on atmospheric CO_2 levels. For example, assuming an immediate and sustained 25 percent reduction in U.S. CO_2 fossil fuel emissions from 1990 forward, atmospheric CO_2 concentrations would decline from 401 ppm to 398 ppm in 2015, a 3 ppm reduction (see Exhibit 3B).[48]

---

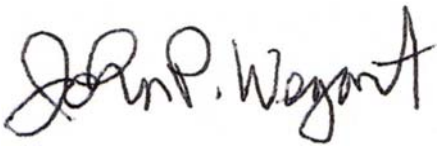
[45] MAGICC has a carbon cycle that describes how atmospheric CO_2 concentrations change as a function of emissions and a climate model that relates greenhouse gas concentrations to radiative forcing and mean surface temperature. Major carbon sources and syncs in the carbon cycle component of MAGICC include (1) CO_2 emissions from fossil fuel combustion, industrial activity, and other human-related activity such as agriculture; (2) carbon sequestration in the ocean; and (3) carbon sequestration in land-based biomass. For more details, see Malte Meinshausen et al., "Emulating Coupled Atmosphere-Ocean and Carbon Cycle Models with a Simpler Model, MAGICC6 – Part 1: Model Description and Calibration," *Atmospheric Chemistry and Physics* 11, no. 4 (2011), pp. 1417–1456 ("Meinshausen et al. (2011)").

[46] Meinshausen et al. (2011).

[47] MAGICC 6 makes several updates to previous versions, including a more detailed carbon cycle. Meinshausen et al. (2011) provide a summary.

[48] If asked, I could do this calculation for other assumptions about U.S. CO_2 emissions.

Executed this 13th day of August, 2018



John P. Weyant, Ph.D.

Appendix A

CURRICULUM VITAE

(as of August 11, 2018)

John P. Weyant

BACKGROUND

ADDRESSES

Room 260 Huang Engineering Center
Stanford University
Stanford, CA 94305-4121
(650) 723-3506

861 Allardice Way
Stanford, CA 94305
(650) 494-3570

PROFESSIONAL INTERESTS

Application of quantitative methods to policy development and strategic planning.

ACADEMIC APPOINTMENTS

STANFORD UNIVERSITY

Professor – Dept. of Management Science and Engineering (1/2000 – present)
Professor- Engineering-Economic Systems and Operations Research (9/96-12/99)
Professor - Department of Engineering-Economic Systems (9/89-8/96)
Associate Professor - Department of Engineering-Economic Systems (9/84-8/89)
Senior Research Associate - Department of Operations Research (9/80-8/84)
Research Associate - Department of Operations Research (6/77-8/80)

EDUCATION

HARVARD UNIVERSITY:

Postdoctoral Fellow - John F. Kennedy School of Government
Research Topic: Quantitative Models in Energy Policy

UNIVERSITY OF CALIFORNIA, BERKELEY:

Doctor of Philosophy - Management Science
Minor Fields: Economics, Operations Research, Organization Theory

RENSSELAER POLYTECHNIC INSTITUTE:

Master of Science in Operations Research and Statistics
Master of Science in Management
B.S. in Aeronautical Engineering and Astronautics

RESEARCH EXPERIENCE

STANFORD UNIVERSITY

PROGRAM ON INTEGRATED ASSESSMENT MODELING DEVELOPMENT DIAGNOSTICS AND INTERCOMPARISONS: Cutting edge research on uncertainty, technology dynamics, and fine scale climate impacts, model diagnostics development, and scenario ensemble construction for IAM community- Lead PI (20 PIs at seven institutions) 8/10-

ENERGY MODELING FORUM: The EMF conducts systematic comparative studies of energy-economic models applied to policy problems of current interest.
Director (9/84-present)
Executive Director (J.L. Sweeney, Director): 1/83 - 8/84
Deputy Director (J.L. Sweeney, Director): 12/79 – 12/82
Associate Director (J.L. Sweeney, Director): 8/78 – 11/79
Research Staff (W.W. Hogan, Director): 6/77 – 11/79

SNOWMASS SUMMER WORKSHOPS ON INTEGRATED ASSESSMENT OF CLIMATE CHANGE: Inter-disciplinary workshops on critical issues for integrated assessment - 6/95-

PRECOURT INSTITUTE FOR ENERGY EFFICIENCY:
Deputy Director (J.L. Sweeney, Director): 9/07-present

GLOBAL CLIMATE AJND ENERGY PROJECT
Staff (Lynn Orr, Director): 9/02-9/06

GENERAL MOTORS COLLABORATIVE LABORATORY ON WORK SYSTEMS
Co-Director (With Arthur Veinott): 9/00-9/03

INTERNATIONAL ENERGY PROGRAM: The IEP conducted studies on international energy policy issues of current interest.
Research Staff (A.S. Manne, Director). 7/81 – 8/85
Research Staff (H.S. Rowen, Director): 9/77 - 6/81

COMBINING ENERGY MODELS PROJECT: The CEM project attempted to develop a set of rules for the combination of energy models of different types.
Research Staff (W.W. Hogan & L.J. Lau, Principal Investigators): 8/77 - 4/81

HARVARD UNIVERSITY

ENERGY AND ENVIRONMENTAL POLICY CENTER: 4/76 - 6/77

RAND CORPORATION (Summer Internships)

Air Force Energy Problems (for J.R. Gebman): 6/75 - 3/76
Air Force R&D Planning (for G.K. Smith): 6/74 - 9/74
Air Quality Modeling (for J.R. Gebman): 6/72 - 9/72
Aerodynamics Computer Module (for G.K. Smith): 6/70 - 9/70

U.C., BERKELEY

ENERGY & RESOURCES PROGRAM:
Post Graduate Researcher (J.P. Holden, Director): 9/74-6/75

OPERATIONS RESEARCH CENTER:
Postgraduate Researcher (R.C. Grinold, Director): 10/72-12/73

TEACHING EXPERIENCE

STANFORD UNIVERSITY

COURSES TAUGHT:

Energy Policy and Strategy Modeling (EES 283 & EES&OR 483 & MS&E 473)
1979 – 2001
International Environmental Policy (MS&E 92Q): 2001-present
Policy and Strategy Analysis (MS&E 190): 2006-2009
Public Policy Analysis (MS&E 290): 2000-2006 (with William Perry)
Climate Policy Analysis (MS&E 294): 2004-present
Energy Policy Analysis (MS&E 295): 2005-present
Doctoral Research Seminar in Advanced Energy and Environmental Analysis
(MS&E 391): 2011-present.
Entrepreneurship through the Lens of Venture Capital
(MS&E 476): 2014-present (with Ernestine Fu)
The Energy Seminar
(MS&E 494): 2014-present
Entrepreneurship from Business to Government
(MS&E 477): 2015-present (with Ernestine Fu)

Seminar on Business & Technology
Department of Engineering-Economic Systems 1987 – 1993
Models and Applications of Operations Research in Society (O.R. 50/150)
Department of Operations Research 1979-1980

Contingency Planning – The World Oil Market
(O.R. 348 A, B, and C, with A. S. Manne)
Department of Operations Research 1981 – 1982

Financial Decisions, IE 235
Department of Industrial Engineering
Winter 1990, fall 1990, Winters 1993, 1994 & 1995

DISSERTATION COMMITTEES (Total – 191; Principal Adviser – 42):

Principal Advisees (Completed Only)

Gregory Hamm (Engineering-Economic Systems – 1986)
Xia Shi (Engineering-Economic Systems – 1989)
Douglas Robinson (Engineering-Economic Systems – 1990)
Peter Lilienthal (Engineering-Economic Systems- 1991)
Hean-Lee Poh (Engineering-Economic Systems -1991)
Sylvia Kwan (Engineering-Economic Systems – 1994)
Eric Johnson (Engineering-Economic Systems – 1994)

Ming-Fai Sit (Engineering-Economic Systems – 1994)
Elisabeth Browne (Engineering-Economic Systems – 1995)
Thomas Hoff (Engineering-Economic Systems and Operations Research – 1996)
Robert Earle (Engineering-Economic Systems and Operations Research – 1996)
Chi-Peng Chu (Engineering-Economic Systems and Operations Research – 1996)
Shu-Cheng Liu (Engineering-Economic Systems and Operations Research – 1997)
Enrique Garza-Escalante (Eng.-Economic Systems and Operations Research- 1998)
Quingxuan Meng (Engineering-Economic Systems and Operations Research – 1998)
Michael Hsu (Engineering-Economic Systems and Operations Research – 1999)
Akira Maeda (Engineering-Economic Systems and Operations Research – 1999)
Karen (Cushing) Sepucha (Eng.-Economic Systems and Operations Research – 1999)
Karl Knapp (Eng.-Economic Systems and Operations Research – 1999)
Kevin Zhu (Eng.-Economic Systems and Operations Research – 1999)
Antje Kann (Eng.-Economic Systems and Operations Research – 2000)
Wenlong Weng (Eng.-Economic Systems and Operations Research – 2001)
Michelle Freed (Eng.-Economic Systems and Operations Research – 2001)
John McConnell (Eng.-Economic Systems and Operations Research – 2001)
Erin Baker (Eng.-Economic Systems and Operations Research – 2002)
Jochen Kleinknecht (Eng.-Economic Systems and Operations Research – 2002)
Kazuhiro Ninomiya (Management Science and Engineering – 2003)
Tao Yao (Management Science and Engineering – 2005)
Albert Whangbo (Management Science and Engineering – 2005)
Geoff Blanford (Management Science and Engineering – 2006)
Oytun Eskiyenenturk ((Management Science and Engineering – 2006)
Leslie Holmes Hummel (Interdisciplinary Program on Environment and Resources-2006)
Katherine Calvin (Management Science and Engineering-2007)
Dhruv Sharma (Management Science and Engineering -2010)
Nikit Abhyankar (Interdisciplinary Program on Environment and Resources -2013)
Danny Cullenward (E-IPER & JD Stanford Law School- 2013)
John Bistline (Management Science and Engineering – 2013)
Jordan Wilkerson (Management Science and Engineering – 2014)
Delavane Diaz (Management Science and Engineering – 2015)
Ben Leibowicz (Management Science and Engineering – 2016)
Karim Farhat (Management Science and Engineering – 2016)
Lauren Culver (Management Science and Engineering – 2017)

ENGINEER'S THESIS ADVISEES (3):

Teodoro Myslabodski (Operations Research)
Anousheh Alamzad (Engineering-Economic Systems)
Vincent Lui (Engineering-Economic Systems and Operations Research)

OTHER ACTIVITIES

MAJOR ADVISORY BOARDS AND COMMITTEE MEMBERSHIPS

- N.R.C. Committee on Nuclear and Alternative Energy Systems (1975-77)
- The Institute for the Future – Advisory Board on NSF Interactive Modeling (1978-82)
- Scientists' Institute for Public Information – Oil Emergency Task Force (1980)
- Energy Research Commission of Sweden-Research Program Evaluation Comm. (1982-84)
- Office of Technology Assessment – Advisory Board on U.S. Gas Supply (1983-84)
- Chairman: E.P.A. Peer Review Panel on Acid Deposition Research (1983-87)
- Advisory Board – Electric Power Research Institute Visibility Valuation Project (1983-87)
- National Academy of Sciences: Committee on the Gas Research Institute (1985-87)
- Advisory Board on Utility Model Reviews, California Public Utilities Commission (1986-89)
- Peer Reviewer Final Assessment Report-National Acid Precipitation Assessment Prog. (1990)
- Secretary of Energy Advisory Board (1992-1993)
- Nat. Renewable Energy Lab., Analytic Studies Division Advisory Board (1993-1996)
- Convening Lead Author: Intergovernmental Panel on Climate Change Second Assessment Report, Chapter on Integrated Assessment– Working Group III on Economic and Social Dimensions (1993-1995)
- Lead Author: The Contribution of the Social Sciences to Global Climate Change Policy: A State of the Art Report (1993-1996)
- Director: Snowmass Workshops on Climate Change Impacts and Integrated Assessment (1995-)
- Advisory Board, Consortium on International Earth Sciences Information Network (1995-2002)
- Lead Author, Intergovernmental Panel on Climate Change, Special Report on Emissions Scenarios (1996-1998).
- Advisory Board: Yale/National Bureau of Economic Research Program on Economics and Policy Issues in Global Warming National Science Foundation Center (1996-2005)
- Adviser: National Institute for Environmental Studies, Japan (1997-)
- Chairman: External Review Panel- Electric Power Research Institute: Environment Division
- Coordinating Lead Author, Intergovernmental Panel on Climate Change, Third Assessment Report, Working Group II on Climate Impacts and Working Group III on Climate Change Mitigation (1998-2001).
- Independent Expert Review Panel, Energy Information Administration Report on Likely Costs and Energy Sector Impacts of the Kyoto Protocol on Climate Change Policy, Report Prepared for the U.S. House of Representatives Committee on Science (1998).
- Chairman, Lawrence Berkeley Laboratory, Director's Review Panel, Environmental Energy Technologies Division (1998, 2003, 2008, 2011, 2015).
- Co-founder, The Boathouse Group of Climate Negotiators fro the twelve largest carbon emitting countries (2003-).
- Review Editor, Intergovernmental Panel on Climate Change, Assessment Report Number Four, (2004-2007).
- California Air Resources Board, (ARB) –Economic and Technology Advancement Advisory Committee (ETAAC) (2007-).
- World Bank – Academic Advisory Board for World Development Report on Climate Change – 2010.
- Chairman, Scientific Advisory Board, European Commission's AMPERE Project on Integrated Assessment Model Diagnostics.

- Steering Committee, Latin American Modeling Project
- Member: Economic and Technology Advancement Advisory Committee to the California Air Resources Board on Implementation of AB32 the Climate Solutions Act of 2006
- American Statistical Association Review Committee, the Energy Information Administration – U.S. Department of Energy (2006-2012) (2015-).
- Co-Editor in Chief , Energy Economics
- Editorial Board, The Energy Journal
- Chairman: Scientific Steering Committee of the Integrated Assessment Modeling Consortium (IAMC) - 50 International Member Institutions (2007-present).
- National Academy of Sciences Committee on America's Climate Choices; Advancing the Science of Climate Change, Board on Atmospheric Sciences and Climate, National Academy of Sciences (2008-2010).
- Review committee member and chair: International Institute for Applied Systems Analysis.
- Participant, Forums on Global Change, Joint Program on the Science and Economics of Global Change, Massachusetts Institute of Technology.
- Adviser: National Institute for Environmental Studies, Japan.
- Member, Steering Committee, The International Project on "Developing a Technology Strategy for Dealing With Climate Change," Lead by Pacific Northwest National Laboratory for An International Consortium of Government and Industry Sponsors.
- Review Editor, Inter-Governmental Panel on Climate Change Report Number Five, (2010-2013).
- Chairman, Scientific Advisory Board, European Commission's ADVANCE Project on Cutting Edge Research for Integrated Assessment Modeling.
- Chairman, Scientific Advisory Board, European Commission's Climate and Development Linkages (CD-LINKS) Project on Cutting Edge Research for Integrated Assessment Modeling.
- Biological and Environmental Research Advisory Board, Office of Science, U.S. Department of Energy (2014-).
- National Academy of Sciences Committee on Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, Board on Atmospheric Sciences and Climate, National Academy of Sciences (2015-2017).

OTHER UNIVERSITY ACTIVITIES

Freeman Spogli Institute for International Studies
SENIOR FELLOW (1998-2012)

Woods Institute for the Environment
SENIOR FELLOW (2007-2016)

Precourt Institute for Energy
SENIOR FELLOW (2010-)

Northeast Asia - United States Forum on International Policy
FELLOW (1982 - 1985)

Engineering Library Committee
MEMBER 1986-1995
CHAIRMAN 1988-1991

University Committee on Libraries
MEMBER 1988-1991

OFFICES IN PROFESSIONAL SOCIETIES

President, Northern California Chapter-International Association of Energy Economists
Vice President, U.S. Institute of Energy Economics
Vice President, International Association for Energy Economics
Chairman, IAEE Nominating Committee for 1989
Selection Committee – Best Paper in the Energy Journal for 1997 - 1998

CONSULTING

Rand Corporation
Electric Power Research Institute
U. S. Department of Energy
Environmental Protection Agency
Pan Heuristics
Applied Decision Analysis
Science Applications, Inc.
Charles River Associates
U.S. Arms Control and Disarmament Agency
United States Synthetic Fuels Corporation
National Acid Precipitation Assessment Program
California Energy Commission
Federal Trade Commission

MAJOR HONORS and AWARDS

STANFORD UNIVERSITY

Outstanding Contributions to the Profession Award for 2017, International Association for Energy Economics (Maximum One Award per Year)

Adelman Frankel Award for 2008, U.S. Association for Energy Economics, for Unique and Enduring Contributions to the Field (Maximum One Award per Year)

Nobel Peace Prize, 2007, Significant Contributions to the Intergovernmental Panel on Climate Change Award.

HARVARD UNIVERSITY:

POSTDOCTORAL FELLOW, National Science Foundation, Harvard University (1976-1977)

UNIVERSITY OF CALIFORNIA, BERKELEY:

REGENTS FELLOW (1972-1974)
DISTINCTION Plus, Ph.D. Qualifying Examination in Economic Theory (June 1973)
DISTINCTION Plus, Ph.D. Qualifying Examination in Operations Research (September 1973)
DISTINCTION Plus, Ph.D. Qualifying Examination in Management Science (Dec. 1973)

PUBLICATIONS

JOURNAL ARTICLES

R.C. Grinold and J.P Weyant (1976). "The Transition Fractions in Organizational Manpower Planning Models," Behavioral Science, Vol. 21, No. 4, pp. 240-251.

J.P. Weyant (1978). "A Comparative Analysis of Three of ERDA's Major R & D Programs Energy - The International Journal, Vol. 3, No. 6, pp. 747-768.

J.L. Sweeney and J.P Weyant (1978/79). "The Energy Modeling Forum: Past, Present, and Future," Journal of Business Administration, Vol. 10, Nos. 1 and 2, pp. 295-320.

A.S. Manne, R.G. Richels and J.P Weyant (1979). "Energy Policy Modeling: A Survey," Operations Research, January/February (feature article), Vol. 27, No. 1, pp. 1-36.

J. P. Weyant, "Quantitative Models in Energy Policy (1980)," Policy Analysis, Published by the University of California, spring 1980, pp. 211-234.

H.S. Rowen and J.P Weyant (1981). "Oil and National Security: An Integrated Program for Surviving an Oil Crisis," Annual Review of Energy, Vol. 6, pp. 171-198.

W.W. Hogan, J.L. Sweeney and J.P Weyant (1981). "Aggregate Elasticity of Energy Demand," The Energy Journal, Vol. 2, No. 2, April, pp. 37-76.

B. Ball, J. Houghton, J.L. Sweeney and J.P Weyant (1981). "U.S. Oil and Gas Supply," in J.B. Ramsey, ed., The Economics of Exploration for Natural Resources, Contemporary Studies in Economic and Financial Analysis, Vol. 26, pp. 119-149.

Theodore Myslabodski and J.P Weyant (1981). "Managing an Oil Bonanza: An Analysis of Alternative Mexican Export Policies," Energy Policy, September, Vol. 9, No. 3, pp. 186-196.

H.S. Rowen and J.P Weyant (1981). "Will Oil Prices Collapse?" Challenge; The Magazine of Economic Affairs, November/December, Vol. 24, No. 5, pp. 11-17.

D.M. Kline and J.P Weyant (1982). "Reducing Dependence on Oil Imports," Energy Economics, January, Vol. 4, No. 1, pp. 51-64.

H.S. Rowen and J.P Weyant (1982). "Reducing the Economic Impacts of Oil Supply Interruptions; An International Perspective," The Energy Journal, January (feature article), Vol. 3, No. 1, pp. 1-34.

W.W. Hogan and J.P Weyant (1982). "Combined Energy Models," in J. R. Moroney, editor, Formal Energy and Resource Models, Advances in the Economics of Energy and Resources, Vol. 4, pp. 117-150.

H.G. Huntington, J.L. Sweeney and J.P. Weyant (1982). "Modeling for Insights, Not Numbers; The Experiences of the Energy Modeling Forum," OMEGA; The International Journal of the Management Sciences, August, Vol. 10, No. 5, pp. 449-462.

J.P. Weyant and D.M. Kline (1982). "Policies to Reduce OECD Vulnerability to Oil Supply Disruptions," Energy - The International Journal, December, Vol. 7, No. 6, pp. 199-211.

J.P. Weyant (1982). "OPEC and the Oil Glut: Outlook for Oil Export Revenues during the 1980s and 1990s" OPEC Review, winter, Vol. VI, No. 4, pp. 333-364.

W.W. Hogan and J.P. Weyant (1983). "Methods and Algorithms for Combining Energy Models; Optimization in a Network of Process Models," in B. Lev, editor, "Energy Models and Studies," Studies in Management Science and Systems, Vol. 20, pp. 3-43.

J.P Weyant and D.M. Kline (1983). "Key Determinants of Optimal Oil Import Tariffs; An International Perspective," Energy Policy, June, Vol. 11, No. 2, pp.101-118.

J.P. Weyant (1983). "Reducing the Economic Impacts of Oil Supply Interruptions; Reply," The Energy Journal, April, Vol. 4, No. 2, pp. 59-61.

J.P. Weyant (1983). "The Energy Crisis is Over ... Again?" Challenge: The Magazine of Economic Affairs, September/October, Vol. 26, No. 4, pp. 12-17.

J.P. Weyant (1983). "Comment on the International Energy Agency's World Energy Outlook," The Energy Journal, Vol. 4, No. 4, pp. 91-94.

J.P. Weyant (1984). "The Continuing Threat of Oil Supply Interruptions," Journal of Policy Analysis and Management, Vol. 3, No. 3, pp. 393-405.

T.E. Daniel, H.G. Goldberg, and J.P. Weyant (1984). "Canadian Gas Exports to the U.S.; A Monopolistic Intertemporal View," The Energy Journal, October, Vol. 5, No. 4, pp. 21-34.

A.S. Manne, J.P. Weyant, C. Nelson, and R. So (1985). "A Contingency Planning Model of the International Oil Market," Applications of Management Science, Vol. 4, pp. 1-35.

S.C. Peck and J.P. Weyant (1985). "Electricity Growth in the Future," The Energy Journal, Vol. 6, No. 1, January, pp. 23-43.

J.P. Weyant (1985). "General Economic Equilibrium as a Unifying Concept in Energy-Economic Modeling," Management Science, May, Vol. 31, No.5, pp. 548-563.

J.P. Weyant (1985). "Using Data Analysis and Modeling in Planning," Petroleum Management, July, Vol. 7, No. 7, pp. 35-37.

J.P. Weyant (1986). "The Price Collapse of '86," Petroleum Management, June, Vol. 8, No.6, pp. 20-23.

M.A. Beltramo, A.S. Manne, and J.P Weyant (1986). "A North American Gas Trade Model: GTM," The Energy Journal, June, Vol. 7, No. 3, pp. 15-32.

S.C. Peck, D.K. Bosch, and J.P. Weyant (1988). "Industrial Energy Demand: A Simple Structural Approach," Resources and Energy, June, Vol. 10. No. 2, pp.111-134.

J.P. Weyant (1988). "Is There Policy-Oriented Learning in the Analysis of Natural Gas Policy Issues?" Policy Sciences, Vol. 21, pp. 239-261.

T.A. Kuczmowski and J.P. Weyant, editors (1990). "Energy Modeling for an Uncertain Future: Modeling for Policy Development," Part I of Special Issue of Energy - The International Journal, March/April, Volume 15, Number 3/4.

T.A. Kuczmowski and J.P. Weyant, editors (1990). "Energy Modeling for an Uncertain Future: Models for Decision Making,""Engineering-Economic Modeling: Energy Systems," Part II of Special Issue of Energy - The International Journal, May/June, Volume 16, Number 1/2.

J.P. Weyant (1990). "Application of Models in the Process of Legislation," Energy: The

International Journal, April, Vol. 15, No. 3/4, pp. 187-201.

J.P. Weyant (1990). "Policy Modeling: An Overview," Energy: The International Journal, April, Vol. 15, Nos. 3/4, pp. 203-206.

J.P. Weyant (1990). "Integrated Models," Energy: The International Journal, June 1990, Vol. 15, No. 4, pp. 341-345.

J.P. Weyant (1990). "Energy-Economy Models: A Survey," Energy: The International Journal, June 1990, Vol. 15, No. 4, pp. 387-395.

D.W. Gaskins and J.P. Weyant (1993). "Model Comparisons of the Costs of Reducing CO_2 Emissions," American Economic Review, May, Volume 83, Number 2, pp. 318-323.

J.P. Weyant (1993). "Costs of Reducing Global Carbon Emissions," Journal of Economic Perspectives, Vol. 7, No. 4, fall, pp. 27-46.

J.P. Weyant (1996). "Commentary on the IPCC Energy Assessment," Energy Policy, Vol. 24, Nos. 10/11, October/November, pp. 1005-1008.

J.P. Weyant and Thomas Olavson (1999). "Issues in Modeling Induced Technological Change in Energy, Environment, and Climate Policy," Journal of Environmental Management and Assessment, Vol. 4, pp. 67-85.

J.P. Weyant and Jennifer Hill (1999). "Introduction and Overview of The Costs of the Kyoto Protocol: A Multi-Model Evaluation," The Energy Journal, Special Issue, pp. vii-xiv.

H.S.Rowen and J.P. Weyant (1999). "Staying Cool About Global Warming," The National Interest, No. 57, Fall, pp. 87-93.

Antje Kann and J.P. Weyant (1999). "A Comparison of Approaches for Performing Uncertainty Analysis in Integrated Assessment Models," Journal of Environmental Management and Assessment, Vol.5, No.1, pp 29-46.

T. Hoff, C. Herig, H.Wenig, and J.P Weyant (2001). "Reduce, Reuse, Renew: One Possible Approach to Cutting Carbon Emissions," International Journal of Global Energy Issues, Vol.15, Issue.1-2, February, pp. 73-83

J. Hartmann, K. Ebi, K.J. McConnell, N. Chan and J.P. Weyant (2002). "Climate Suitability for Stable Malaria Transmission in Zimbabwe under Different Climate Change Scenarios," Global Change and Human Health, Vol. 3, No. 1, pp.2-14.

Kevin Zhu and J.P. Weyant (2003). "Strategic Exercise of Real Options: Investment Decisions in Technological Systems," Journal of Systems Science and Systems Engineering, Vol. 12, No. 3,

September, pp. 257-278.

Kevin Zhu and J.P. Weyant (2003). "Strategic Decisions of New Technology Adoption Under Asymmetric Information: A Game Theoretic Model," Decision Sciences, Vol. 34, No. 4, pp. 643-675.

John P. Weyant, editor (2004). "EMF 19: Alternative Technology Strategies for Climate Change Policy," Energy Economics, Special Issue, Vol. 26, No. 4, pp. 501-755.

John P. Weyant (2004). "Introduction to Alternative Technology Strategies for Climate Change Policy," Energy Economics, Special Issue, Vol. 26, No. 4, pp. 501-525.

Kristie L. Ebi, Jessica Hartman, Nathan Chan, John McConnell, Michael Schlesinger and John Weyant (2005). "Climate Suitability for Stable Malaria Transmission in Zimbabwe under Different Climate Change Scenarios," Climatic Change, Vol. 73, No. 3, pp. 375-393.

Detlef van Vuuren, John Weyant, and Francisco de la Chesnaye (2006). "Multigas Scenarios to Stabilize Radiative Forcing," Energy Economics, Vol. 28, No. 1, January, pp. 102-120.

Erin Baker, J.P. Weyant and L.G. Clarke (2006). "Optimal Technological R&D in the Face of Climate Uncertainty." Climatic Change, Vol.78, No. 1, September, pp. 157-179.

Leon Clarke, John Weyant, and Alison Birky (2006). "On the Sources of Technological Advance: Assessing the Evidence," Energy Economics, Vol. 28, No. 5-6, November, pp. 579-595.

Leon Clarke, John Weyant, Jae Edmonds (2006). "The Sources of Technological Advance: What do the Models Assume?" Energy Economics, In Press.

Jae Edmonds, Tom Wilson, Marshall Wise and John Weyant (2006). "Electrification of the Economy and CO_2 Emissions Mitigation," Environmental Economics and Policy Studies, Vol. 7, pp. 175-203.

John P. Weyant, Francisco C. de la Chesnaye, and Geoff J. Blanford (2006). "Overview of EMF-21: Multigas Mitigation and Climate Policy," in Special Issue of The Energy Journal, Francisco C. de la Chesnaye and John P. Weyant, editors, December, pp. 1-32.

John P. Weyant (2007). "Comment on Alternative Measures of Output in Global Economy-Environmental Models: Purchasing Power Parity or Market Exchange Rates," Energy Economics, Vol. 29, No. 3, May, pp. 375-377.

John P. Weyant (2008), "A Critique of the Stern Review's Mitigation Cost Analyses and Integrated Assessment" Review of Environmental Economics and Policy, 2: 77-93

Sonia Yeh, Alex Farrell, Richard Plevin, Alan Sanstad and John Weyant (2008). "Optimizing U.S. Mitigation Strategies for the Light-Duty Transportation Sector: What We Learn from a Bottom-Up Model," Environ. Sci. Technol., 42 (22), pp 8202–8210.

John P. Weyant (2009). A Perspective on Integrated Assessment, Climatic Change, 95:317-323.

Allen A. Fawcett, Katherine V. Calvin, Francisco C. de la Chesnaye, John M. Reilly, John P. Weyant (2009). " Overview of EMF 22 U.S. Transition Scenarios," Energy Economics, Vol. 31, Supplement 1, Pages S198-S211, Available online 28 October.

Leon Clarke, John Weyant (2009). Energy Economics, Introduction to the EMF 22 Special Issue on Climate Change Control Scenarios, Vol. 31, Supplement 1, Page S63, Available online 26 October.

Richard H. Moss, .., John P. Weyant. (2010). The Next Generation of Scenarios for Climate Change Research and Assessment, Nature, Vol. 463, No. 7282, 11 February, pp 747-756.

Detlef P. van Vuuren,, James A. Edmonds, Mikiko Kainuma, Keywan Riahi and John P. Weyant (2011) Special Issue: The Representative Concentration Pathways in Climatic Change, Climatic Change:109:1-2, 241 pp. Introduction and Overview paper plus editor of whole volume.

John P. Weyant (2011). Accelerating the development and diffusion of new energy technologies: Beyond the "Valley of Death", Energy Economics, Volume 33(4): 674-682.

Pamela. A. Matson, Thomas Dietz…, John P. Weyant, et al. (2010), America's Climate Choices; Advancing the Science of Climate Change, Board on Atmospheric Sciences and Climate, National Academy of Sciences.

Tao Yao, John Weyant, Baichun Feng (2011). "Competing or Coordinating: IT R&D Investment Decision Making Subject to Information Time Lag", Information Technology and Management, Vol. 12 (3), 213-228.

Leon.E. Clarke, Volker. Krey, and John.P. Weyant (2012), "Regional Energy System Variation in Global Models: Results From the Asian Modeling Exercise Scenarios," Energy Economics, Volume 34 Supplement 3: S293–S305.

Christoff Böhringer, C., Thomas.F. Rutherford, Edward J. Balistreri and John P. Weyant (2013), "Introduction to the EMF 29 Special Issue on the Role of Border Carbon Adjustment in Unilateral Climate Policy," Special Issue of Energy Economics, Volume 34, Supplement 2: S95-S250.

John E. Bistline and John P.Weyant (2013), "Electric Sector Investments under Technological and Policy-Related Uncertainties: A Stochastic Programming Approach," Climatic Change,

November, 121(2): 143–160.

John P. Weyant, Brigette Knopf, Enrica De Cian, Ilka. Keppo, and Detlef P. van Vuuren (2013), "Introduction to the EMF 28 Study on Scenarios for Transforming the European Energy System," Climate Change Economics, Vol. 4, Suppl. 1. (Also, editors of whole special issue volume).

Jordan T. Wilkerson, Danny Cullenward, Danielle Davidian, and John P. Weyant (2013). "End Use Technology Choice In The National Energy Modeling System (NEMS): An Analysis of the Residential and Commercial Building Sectors" Energy Economics, Volume 40, November, Pages 773-784.

Elmar Kriegler, John P. Weyant, et al. (2014). "The Role of Technology for Achieving Climate Policy Objectives: Overview of the EMF 27 Study on Global Technology and Climate Policy," Special Issue of Climatic Change, Volume 123, pp. 345-352, (also editors of two volume special issue, 438 p.).

Masahiro Sugiyama, O. Akashi, Ken Wada, Amit. Kanudia, Jia Li, and John P. Weyant (2014), "Energy Efficiency Potentials in Global Climate Change Mitigation; A Comparison of Modeling Approaches," in Special Issue of Climatic Change Volume 123: 397-411.

Stephen Rose, Elmar Kriegler, Alexander Popp, and John P. Weyant (2014), "Bioenergy in Energy Transformation and Climate Management," Climatic Change. Volume 123, pp. 345-352, p. 773-784.

John P. Weyant, Allen A. Fawcett, Leon Clarke, eds. (2014). "The role of technology for achieving climate policy objectives: overview of the EMF 24 study on U.S. technology and climate policy," Energy Journal Special Issue on U.S. Technology And Climate Policy, Volume 35, Special Issue #1, p. 1-8 (also edited whole volume, 247 p.)

Allen A. Fawcett, Leon C. Clarke, Sebastian Rausch, John P. Weyant (2014), **"**Overview of EMF 24 policy scenarios," The Energy Journal, Volume 35, Special Issue #1, p. 33-60.
Clarke, L.C., Fawcett, A.A., McFarland, J., Weyant (2014), "Overview of the EMF 24 technology scenarios," Energy Journal, Volume 35, Special Issue #1, p. 33-60.

Elmar Kriegler, Keywan Riahi, Valentina Bosetti, Pantelis Capros, Nils Petermann, Detlef P. van Vuuren, John P. Weyant, and Ottmar Edenhofer (2015), "Introduction to the AMPERE Model Intercomparison Studies On The Economics Of Climate Stabilization," Technological Forecasting and Social Change, Volume 90, Part A, Pages 1-354.

John P. Weyant (2014). Integrated assessment of climate change: state of the literature. Journal of Benefit-Cost Analysis, 5:377-409. doi:10.1515/jbca-2014-9002.

Jordan T. Wilkerson, Benjamin D. Leibowicz, Delavane Diaz Turner, and John P. Weyant (2015), "Comparison of Integrated Assessment Models: Carbon Price Impacts on U.S. Energy,"

Energy Policy 01/2015; 76(January):18-3.

Maureen Cropper, Richard. Newell,…, John P. Weyant, National Academies of Sciences, Engineering, and Medicine. 2017. Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press, 2017. https://doi.org/10.17226/24651.

John P. Weyant (2017). "Some Contributions of Integrated Assessment Models of Global Climate Change," Review of Environmental Economics and Policy, Volume 11(1):115–137.

Christopher T. M. Clack, Staffan A. Qvist, Jay Apt, Morgan Bazilian, Adam R. Brandt, Ken Caldeira, Steven J. Davis, Victor Diakov, Mark A. Handschy, Paul D. H. Hines, Paulina Jaramillo, Daniel M. Kammen, Jane C. S. Long, M. Granger Morgan, Adam Reed, Varun Sivaram, James Sweeney, George R. Tynan, David G. Victor, John P. Weyant, and Jay F. Whitacre (2017), "Evaluation Of A Proposal For Reliable Low-Cost Grid Power With 100% Wind, Water, And Solar," PNAS, 114 (26): 6722-6727; published ahead of print June 19, 2017. https://doi.org/10.1073/pnas.1610381114

Allen A. Fawcett, James R. McFarland, Adele C. Morris, and John P. Weyant (2018), "Introduction to the EMF 32 Study On U.S. Carbon Tax Scenarios," Climate Change Economics, Volume 9(1): 1-7. (Also co-editors for whole volume-323 pp)

BOOKS AND CONTRIBUTIONS TO BOOKS

T.C. Koopmans, R.E. Litan, and J.P. Weyant, Energy Modeling for an Uncertain Future, Committee on Nuclear and Alternative Energy Systems, Modeling Resource Group of the Synthesis Panel, National Research Council, December 1977.

W.W. Hogan and J.P Weyant, editors, Coal in Transition: 1980-2000, 3 Volumes, Energy Modeling Forum, Stanford University, Stanford, California, July 1978.

W.W. Hogan and J.P. Weyant, "Stripping the Coal Models: Mining for the Essentials," Appendix A in Coal in Transition: 1980 -2000, Volume 2, Energy Modeling Forum, Stanford University, Stanford, California, September 1978.

J.L. Sweeney and J.P. Weyant, "The Energy Modeling Forum: Past, Present, and Future," in Energy Policy - The Global Challenge, Peter N. Nemetz, editor, Institute for Research on Public Policy, 1979, pp. 295-317 (reprinted from Journal of Business Administration).

R.G. Richels and J.P. Weyant, "Models for Energy Technology Assessment," in Advances in Energy Systems and Technology, Peter Auer, editor, Academic Press, 1979, pp. 179-260.

J.L. Sweeney and J.P Weyant, editors, Aggregate Elasticity of Energy Demand, 2 Volumes, Energy Modeling Forum, Stanford University, Stanford, California, November 1981.

J.P. Weyant, W.W. Hogan and D.R. Fromholzer, "The Design of the Experiment," Chapter 2 in Aggregate Elasticity of Energy Demand, Energy Modeling Forum, Stanford University, Stanford, California, November 1981.

D. Nissen and J.P. Weyant, "Energy System Elasticities," Chapter 5 in Aggregate Elasticity of Energy Demand, Energy Modeling Forum, Stanford University, Stanford, California, November 1981.

J.P. Weyant and J.L. Plummer, "International Institutional Approaches to Energy Vulnerability Problems," in Energy Vulnerability, J.L. Plummer, editor, Ballinger Publishing, 1982.

H.S. Rowen and J.P. Weyant, "Tradeoffs Between Military Policies and Vulnerability Policies," in Energy Vulnerability, J.L. Plummer, editor, Ballinger Publishing, 1982.

J.P. Weyant and D.M. Kline, "Energy Crisis Meets Oil Glut: Implications for Oil Policy during the 1980s," in M.S. Wionczek, editor, World Hydrocarbon Markets: Current Status, Projected Prospects and Future Trends, Pergamon Press, October 1982, pp. 49-74.

J.P. Weyant, A Dynamic Model of The U.S. Energy System: A Tool for Energy R&D Planning, Outstanding Dissertations in Economics Series, Garland Publishing, 1984.

J.P. Weyant and D.B. Sheffield, editors, The Energy Industries in Transition: 1984-2000, proceedings of the Sixth Annual North American Meeting of the International Association of Energy Economists, Westview Press, 1984, Two Vols., 1506 pp.

J.P. Weyant and J.A. Salinas, "A Comparison of Macroeconomic Model Structures," in Macroeconomic Impacts of Energy Shocks, B. Hickman, H. Huntington and J. Sweeney, editors, North Holland Publishing, 1987, pp. 269-331.

J.P. Weyant, "Coordinated Stock Drawdowns: Pros and Cons" in G. Horwich and D.L. Weimer, editors, Responding to International Oil Crises, American Enterprise Institute, 1988, pp. 179-199.

J.P. Weyant, "Is There Policy-Oriented Learning in the Analysis of Natural Gas Policy Issues?" in Policy Sciences, 1988, No. 21, pp. 239-261.

J.P. Weyant, Industrial Energy Demand: Energy Modeling Forum Study Number 8, editor, Energy Modeling Forum, Stanford University, 1990.

J.P. Weyant, "The Technology and Economics of Energy Alternatives," in Louis Rosen and Robert Glasser, editors, Climate Change and Energy Policy, 1992, American Institute of Physics, New York.

J.P. Weyant and D. W. Gaskins, "Tentative Conclusions from Energy Modeling Forum Study Number 12 on Controlling Greenhouse Gas Emissions," in Costs, Impacts, and Benefits of CO_2 Mitigation, International Institute for Applied Systems Analysis, Laxenburg, Austria, June 1993,

pp. 235-246.

J.P. Weyant, "Energy Policy Applications of Operations Research," Chapter 8 in Handbooks in Operations Research and Management Science, Volume 6, Operations Research and the Public Sector, North-Holland, 1994, pp. 263-288.

J.C. Hourcade, K. Halnaes, M. Jacard, W.D. Montgomery, R. Richels, J. Robinson, P.R. Shukla, P. Sturm. W. Chandler, O. Davidson, J. Edmonds, O. Finon, F. Krause, A Kolesov, E. LaRovere, P. Nastari, A. Pegov, K. Richards, L. Schrattenholzer, R. Shackleton, Y. Sokona, A. Tudini, and J.P. Weyant, "A Review of Mitigation Cost Studies," Chapter 9 in Climate Change 1995: Economic and Social Dimensions of Climate Change, Cambridge University Press, 1996.

J.P. Weyant, O. Davidson, H. Dowlatabadi, J. Edmonds, M. Grubb, E.A. Parson, R. Richels, J. Rotmans, PR. Shukla, and R.S.J. Tol, "Integrated Assessment of Climate Change: An Overview and Comparison of Approaches and Results," Chapter 10 in Climate Change 1995: Economic and Social Dimensions of Climate Change, Cambridge University Press, 1996.

J.P. Weyant, "Incorporating Uncertainty in Integrated Assessment of Climate Change," in Elements of Change –1996, Aspen Global Change Institute, 1997, pp. 258-263.

J.P. Weyant, "Insights from Integrated Assessment," in Critical Issues in the Economics of Climate Change, International Petroleum Industry Environmental Conservation Association, 1997, pp. 245-278.

J.P. Weyant, and Yukio Yanigisawa, "Resources and Technology" chapter 4 in Volume 2 of Steve Rayner and Elizabeth L. Malone, editors, Human Choice and Climate Change, Battelle Press, 1998, pp. 203-290.

J.P. Weyant, "The Costs of Carbon Emission Reductions," in William D. Nordhaus, editor, The Economics and Policy Issues in Climate Change, Resources for the Future Press, 1998, pp. 191-214.

J.P. Weyant, "Integrated Assessment Modeling of Climate Change; A Comment," in William D. Nordhaus, Editor, The Economics and Policy Issues in Climate Change, Resources for the Future Press, 1998, pp. 287-290.

Kevin Zhu and J.P. Weyant, "Corporate Investment Options in Competitive Situations," in Leonis Trigeorgis, editor, Innovation and Strategy, Flexibility, Natural Resources and Foreign Investment, Oxford University Press, 1999.

J.P. Weyant, editor and introductory chapter, Energy and Environmental Policy Modeling, Kluwer Academic Publishing, 1999.

J.P. Weyant, editor and introductory chapter, Special Issue of the Energy Journal on "The Costs

of the Kyoto Protocol: A Multi-Model Evaluation," editor, 1999, 398 pp.

Paul Portney and J.P. Weyant, editors and introductory chapter, Discounting and Intergenerational Equity, Resources for the Future Press, 1999.

Weyant, J.P. (contributing author), Special Report on Emissions Scenarios, Intergovernmental Panel on Climate Change, Cambridge University Press, 2000.

Mirza, M.Q., H.J. Schellnhuber, Joel Smith, Samuel Fankhauser, Rik Leemans, Lin Erda, Laban Ogallo, Barrie Pittock, Richard Richels, Cynthia Rosenzweig, Urie Safriel, Richard Tol, J.P. Weyant and Gary Yohe, "Synthesis and Integration of Impacts, Adaptation, and Vulnerability," Chapter 19 in Climate Change 2001:Impacts, Adaptation and Vulnerability, Cambridge University Press, 2001.

Banuri, Tariq, John Weyant, Grace Akumu, Adil Najam, Luiz Pinguelli Rosa, Steve Rayner, Wolfgang Sachs, Ravi Sharma, Ferenc Toth, and Gary Yohe, "Setting The Stage: Climate Change And Sustainable Development," Chapter 1 in Climate Change 2001: Mitigation, Cambridge University Press, 2001.

Banuri, Tariq (Pakistan), Terry Barker (UK), Igor Bashmakov (Russian Federation), Kornelis Blok (Netherlands), John Christensen (Denmark), Ogunlade Davidson (Sierra Leone), Michael Grubb (UK), Kirsten Halsnaes (Denmark), Catrinus Jepma (Netherlands), Eberhard Jochem (Germany), Pekka Kauppi (Finland), Olga Krankina (Russian Federation), Alan Krupnick (USA), Lambert Kuijpers (Netherlands), Snorre Kverndokk (Norway), Anil Markandya (UK), Bert Metz (Netherlands), William R. Moomaw (USA), Jose Roberto Moreira (Brazil), Tsuneyuki Morita (Japan), Jiahua Pan (China), Lynn Price (USA), Richard Richels (USA), John Robinson (Canada), Jayant Sathaye (USA), Rob Swart (Netherlands), Kanako Tanaka (Japan), Tomihiru Taniguchi (Japan), Ferenc Toth (Germany), Tim Taylor (UK), John Weyant (USA), Technical Summary, Climate Change 2001: Mitigation in Climate Change 2001. Cambridge University Press, 2001.

Ferenc Toth, Mark Mwandosya, John Christiansen, Jae Edmonds, Brian Flannery, Carlos Gay-Garcia, Hoesung Lee, Klaus Meyer-Abich, Elena Nikitina, Atiq Rahman, Richard Richels, Ye Riqui, Arturo Villavicencio, Yoko Wake, and John Weyant, "Decision-making frameworks," Chapter 10 in Climate Change 2001: Mitigation, Cambridge University Press, 2001.

Tariq Banuri, Terry Barker, Igor Bashmakov, Kornelis Blok, John Christensen, Ogunlade Davidson, Michael Grubb, Kirsten Halsnaes, Catrinus Jepma, Eberhard Jochem, Pekka Kauppi, Olga Krankina, Alan Krupnick, Lambert Kuijpers, Snorre Kverndokk, Anil Markandya, Bert Metz, William R. Moomaw, Jose Roberto Moreira, Tsuneyuki Morita, Jiahua Pan (China), Lynn Price, Richard Richels, John Robinson, Jayant Sathaye, Rob Swart, Kanako Tanaka, Tomihiru Taniguchi, Ferenc Toth, Tim Taylor, John Weyant, "Technical Summary," for Climate Change 2001: Mitigation, Cambridge University Press, 2001.

Weyant, John P., "Economic Models: How They Work and Why Their Results Differ," in

Climate Change: Science, Strategies and Solutions, Eileen Claussen, Executive Editor, The Pew Center on Global Climate Change, Brill, Boston, 2001.

Weyant, John P., "Review Of Mitigation Cost Studies And Trajectories, And Assumptions That Drive Them," in U.S. Policy on Climate Change: What Next? Frank Loy and Bruce Smart, editors, Aspen Institute, 2002.

Leon E. Clarke and John P. Weyant, "Modeling Induced Technological Change: An Overview," in Technological Change and the Environment, Arnulf Grübler, Nebojsa Nakicenovic, and William D. Nordhaus, editors. Resources for the Future Press, 2002.

Francisco de la Chesnaye and John P. Weyant, editors, Multi-Greenhouse Gas Mitigation and Climate Policy, Special Issue of the Energy Journal, December 2006, 524 p..

Pamela. A. Matson, Thomas Dietz…, John P. Weyant, et al., America's Climate Choices; Advancing the Science of Climate Change, Board on Atmospheric Sciences and Climate, National Academy of Sciences, 2010.

M. Cropper, R. Newell,…, J. Weyant, National Academies of Sciences, Engineering, and Medicine, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press, 2017. https://doi.org/10.17226/24651.

John P. Weyant, contributor to Biological and Environmental Research Advisory Council (BERAC), "Grand Challenges for Biological and Environmental Research: Progress and Future Vision; A Report from the Biological and Environmental Research Advisory Committee," DOE/SC–0190, member of BERAC Subcommittee on Grand Research Challenges for Biological and Environmental Research, 2017 (science.energy.gov/~/media/ber/berac/pdf/Reports/BERAC-2017-Grand-Challenges-Report.pdf).

John Weyant, Ernestine Fu and Justin Bowersock, Renewed Energy: Insights for Clean Energy's Future, Kauffman Fellows Press; 1 edition, August 9, 2018.

CONFERENCE PROCEEDINGS: PEER REVIEWED

J.P. Weyant, "Energy Models in the Policy Process: Oil Price Decontrol and Synthetic Fuels Commercialization," Proceedings of the Second Lawrence Symposium on Systems and Decision Sciences, Berkeley, California, October 3 and 4, 1978.

J.P. Weyant, "The Energy Modeling Forum and Model Assessment: Substitutes or Complements," in Validation and Assessment of Issues of Energy Models, Saul I. Gass, editor, Proceedings of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland, January 10-11, 1979.

J.P. Weyant, "The Experiences of the Energy Modeling Forum," in Beyond the Energy Crisis; Opportunity and Challenge, Third International Conference on Energy Use Management, Berlin, Germany, October 26-30, 1981.

A.S. Manne, J.P. Weyant and K.C. So, "OTM: An International Oil Trade Model," in Energy Markets in the Longer Term: Planning Under Uncertainty, A.S. Kydes and D.M. Geraghty, editors, Proceedings of the IMACS Second International Symposium, Upton, New York, August 1984, pp. 241-244.

J.P. Weyant, "The World Oil Market: Lessons of the Past," in Ten Years After the First Oil Shock, Center for the Study of Foreign Affairs, U. S. Department of State, February 28, 1985.

J.P. Weyant, "Comment on System Effects and Policy Options," in Energy Economics and Politics, proceedings of an International Symposium arranged by the National Energy Administration of Sweden, Stockholm, October 8-10, 1984, pp. 219-221.

J.P. Weyant, "Comparative Model Analyses: Understanding Alternative Projections of Economic Behavior," paper presented at the Workshop for a DOE Economic and Modeling Research Agenda (sponsored by the Task Force on Economic Analysis and Modeling Related to Energy - Secretary of Energy Advisory Board), Oak Ridge National Laboratory, Alexandria, Virginia, June 3-4, 1992.

J.P. Weyant, "Areas of Agreement and Disagreement on Energy Subsidies," Evaluating Energy Subsidies: Information for Today's Policy Choices, Washington, D.C., September 7, 1995.

J.P. Weyant, "Insights From Integrated Assessment and the Role of the Developing Nations in Global Climate Policy Development," proceedings of the IPCC Asia-Pacific Workshop on Integrated Assessment Models, United Nations University, Tokyo, Japan, Intergovernmental Panel on Climate Change, 1997, pp. 109-121.

"Some Perspectives on Future Energy Technologies," Electric Power Research Institute, Annual Research Conference, May 21, 2008.

"The Precourt Institute for Energy Efficiency: An Overview," Global Technology Strategy Project Annual Research Meeting, Joint Global Change Research Institute, University of Maryland and Pacific Northwest Laboratory, May 28, 2008.

"Energy R&D, Facilitating the Great Transition in Energy Systems," Global Climate and Energy Program Annual Research Symposium, October 1, 2008.

"Overview of Climate Change Mitigation Costs," National Academy of Sciences Workshop on Climate Change Economics, October 2, 2008.

"Risk, Uncertainty and Model Validation in Integrated Assessment," Integrated Assessment Research Program, Basic Energy Research, U.S. Department of Energy, November 15, 2008.

'Energy Modeling: Past Present and Future," Acceptance Speech for Adelman-Frankel Award for 2008, International Association for Energy Economics,

New Orleans, December 4, 2008.

"GHG Emissions: Post Kyoto Protocol," The Stanford Kyoto Trans-Asian Dialogue, Kyoto Japan, September 10-11, 2009.

"Making Integrated Assessment More Integrated," National Renewable Energy Laboratory, Golden, Colorado, December 7, 2009.

"Developing Global Climate Scenarios with Integrated Models," National Renewable Energy Laboratory, Golden, Colorado, December 8, 2009.

"The EMF 22 International Climate Policy Scenarios and Beyond:
Are We Whistling in the Grave Yard?" AEA/ IAEE Session on Climate Policy for a Post-Kyoto World, American Economics Association, Annual Meeting, Atlanta, January 3, 2010.

"Global Climate Policy Objectives and Architectures: Are We Whistling in the Grave Yard?" The Energy Seminar, Stanford University, January 6, 2010.

"The Rationale for Developing Global Techno-Economic Scenarios," National Academy of Sciences-Intergovernmental Panel on Climate Change Workshop, Washington, D.C., February 5, 2010.

"Toward a Community of Practice: EMF, Snowmass Workshops and the IAMC," Department of Energy, Climate Change Modeling PI Meeting, Gaithersburg, MD
March 29, 2010.

"Overview and Introduction to Climate Economics" National Academy of Sciences Workshop, Washington, D.C., April 15, 2010.

"Communicating with policy makers –informing not confusing? Two Examples From the Energy Modeling Forum," Snowmass Workshop on Climate Change Impacts and Integrated Assessment, July 30, 2010.

"Stimulating Energy Technology Innovation, Beyond the Valley of Death, Session on "The Economics of Technologies To Combat Global Warming," Snowmass Workshop on Climate Change Impacts and Integrated Assessment, August 3, 2010.

"The Energy Modeling Forum: Past, Present and Future," presentation at the third meeting of the Asian Modeling Exercise, Seoul Korea, September 13, 2010.

"Climate and Energy Policy & Strategy Research at Stanford/MS&E"
Presentation at the 10 Year Anniversary Celebration of the Department of Management Science and Engineering, October 16, 2010.

"Overview on the Progress of the EMF 24 (US) and EMF 27 (Global) Climate Policy Transition

Scenarios With Advanced Technology Impacts Studies," EMF 24/27 Working Group Meeting, Washington, DC, October 24, 2010.

"Progress of the EMF 24 (US) and EMF 27 (Global) Climate Policy Transition Scenarios with Advanced Technology Impacts Studies," Fourth Annual Meeting of the Integrated Assessment Modeling Consortium, Washington, D.C., October 27, 2010.

"Overview of the Activities of the Program on Integrated Assessment Modeling Development, Diagnostics and Inter-Comparison," Fourth Annual Meeting of the Integrated Assessment Modeling Consortium, Washington, D.C. October 28, 2010.

"Climate and Energy Policy Analyses: Current Status and Future Directions," Key note address at the Institute for Operations Research and Management Science (INFORMS) 2010 Annual Meeting, Austin, Texas, November 7, 2010.

"Sources of Technological Change," presentation at the Workshop on R&D Portfolio Analysis Tools and Methodologies, Washington, DC, December 2, 2010

"Perspectives on the Intergovernmental Panel on Climate Change," plenary penal at the Annual Meetings of the American Economics Association, Denver, January 7, 2011.

"Overview of EMF Activities," American Statistical Association Advisory Board to the Energy Information Administration Annual Meeting, March 7, 2011.

"Perspectives on Federal Energy Technology Innovation Policies," panel presentation on the occasion of the retirement of William Perry from the MS&E Department, April 6, 2011.

"The International Energy Workshop at Age Thirty," annual meeting of the International Energy Workshop, Stanford University, Stanford, CA, July 6, 2011.

"Approaches for Dealing with Uncertainty in Energy-Environmental Policy Analyses," Snowmass Colorado, August 1, 2011.

"Progress Report on Integrated Assessment of Climate Change," Symposium Honoring the career of Steven H. Schneider, National Center for Atmospheric Research, Boulder, Colorado, August 26, 2011.

"Progress Report on the Development of the Program on Integrated Assessment Modeling Assessment Development, Diagnostics and Inter-comparisons," DOE Biological and Environmental Research Program Principal Investigators Meeting, Washington, DC. September 21, 2011.

"Progress Report on the Development of the Program on Integrated Assessment Modeling

Assessment Development, Diagnostics and Inter-comparisons," second meeting of the European Commission's Assessment of Climate Change Mitigation Pathways and Evaluation of the Robustness of Mitigation Cost Estimates" (AMPERE) project, Vienna Austria, October 3, 2011.

"Progress Report on the Development of the Program on Integrated Assessment Modeling Assessment Development, Diagnostics and Inter-comparisons," fourth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Vienna Austria October 6, 2011

"Progress Report on EMF 24 and EMF 27," fourth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Vienna Austria October 6, 2011.

"Foundations of Energy Modeling," presentation at Seminar organized by the King Abdullah Petroleum Analysis and Research Center, Dhahran, Saudi Arabia, October 10, 2012.

"Review and Assessment of Approaches to Oil Price Forecasting," presentation at Seminar organized by the King Abdullah Petroleum Analysis and Research Center, Dhahran, Saudi Arabia, October 10, 2012.

"Perspectives on Oil Security," presentation at Seminar organized by the King Abdullah Petroleum Analysis and Research Center, Dhahran, Saudi Arabia, October 10, 2012.

"Introduction to Strategy Concepts for Major Exporting Nations," presentation at Seminar organized by the King Abdullah Petroleum Analysis and Research Center, Dhahran, Saudi Arabia, October 10, 2012.

"Overview of EMF 24, 27 and 28," EMF Working Group Meeting, Potsdam, Germany, November 7, 2012.

"Integrated Assessment of Climate Change," The Climate Works Foundation, San Francisco, January 14, 2013.

"Perspectives on Energy-Environmental Analysis," Annual Symposium of the Joint Institute for Strategic Energy Analysis, National Renewable Energy Laboratory, Golden, Colorado, March 20, 2013.

"The Future of Natural Gas from a Global Energy Perspective," Global Technology Strategy Workshop on the Shale Gas Revolution, Joint Global Change Research Program, Maryland Eastern Shore, April 15, 2013.

"Some Possible Interests of the Financial Community in Climate Change" American Meteorological Association Special Workshop, Washington, DC, June 4, 2013.

"Overview of Approaches to Modeling Technological Change," third meeting of the European Commission's Assessment of Climate Change Mitigation Pathways and Evaluation of the Robustness of Mitigation Cost Estimates" (AMPERE) project, Seville, Spain, May 28, 2013.

"Overview of Approaches to Model Assessment," Third meeting of the European Commission's Assessment of Climate Change Mitigation Pathways and Evaluation of the Robustness of Mitigation Cost Estimates" (AMPERE) project, Seville, Spain, May 29, 2013.

"Progress Report on the Development of the Program on Integrated Assessment Modeling Assessment Development, Diagnostics and Inter-comparisons," Third meeting of the European Commission's Assessment of Climate Change Mitigation Pathways and Evaluation of the Robustness of Mitigation Cost Estimates" (AMPERE) project, Seville, Spain, May 30, 2013.

"Overview of Integrated Assessment," Snowmass Workshop on Climate Change Impacts and Integrated Assessment," Snowmass, Colorado, July 22, 2013.

"An IA Perspective on New Global Scenario Development," Snowmass Workshop on Climate Change Impacts and Integrated Assessment, Snowmass, Colorado, July 29, 2013.

"An IA Perspective on New Global Scenario Development," Aspen Global Change Institute, Aspen, Colorado, August 4, 2013.

"Overview of EMF Climate Change Studies," Washington D.C Roll Out of EMF 24 – U.S. Technology Strategies and Climate Policy, Washington D.C., September 16, 2013.

"Progress Report on the Development of the Integrated Assessment Modeling Consortium," sixth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Tsukuba, Japan, October 28, 2013.

"Progress Report on the Work of the Precourt Energy Efficiency Center" sixth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Tsukuba, Japan, October 29, 2013.

"Progress Report on the Development of the Program on Integrated Assessment Modeling Assessment Development, Diagnostics and Inter-comparisons," sixth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Tsukuba, Japan, October 29, 2013.

"Progress Report on EMF 24 and EMF 27," sixth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Tsukuba, Japan, October 29, 2013.

Developing Global Community Scenarios; Why and How? Center for Climate and Energy Decision Marking Engineering and Public Policy, Carnegie Mellon University November 5, 2013.

*"*The role of simulation models and big data in mitigation and adaptation planning, and how they can be opened up to influence the general public,*"* Conference on "Crowds and Climate Mobilizing Crowds to Develop Ideas and Take Action on Climate Change," Massachusetts Institute of Technology, Cambridge, Massachusetts USA November 7, 2013.

"An Integrated Assessment Community View on the Development of New Global Scenarios," Workshop on the Development of New Global Scenarios, National Academy of Sciences, Keck Center, Washington, DC, December 13, 2013.

"Energy Modeling Forum Study 27: The Role of Technology for Achieving Climate Policy Objectives," White House International Policy Development Group, Old Executive Office Building, Washington, DC, December 20, 2013.

"Evaluation of EU AMPERE Climate Policy Analysis Project by AMPERE External Science Advisory Panel," EU Headquarters, Brussels, Belgium, January 21, 2014

"Perspectives on Energy-Environmental Analysis," Annual Symposium of the Joint Institute for Strategic Energy Analysis, National Renewable Energy Laboratory, Golden, Colorado, March 23, 2014.

"Summary Assessment of the Latin American modeling Project," Bogota, Columbia, April 29.

"Progress Report on the Development of the Program on Integrated Assessment Modeling Assessment Development, Diagnostics and Inter-comparisons," DOE Biological and Environmental Research Program PI Meeting, Rockville, Maryland, May 30, 2014.

"Overview of IPCC Mitigation Work for Governors Briefing on Climate Policy Analysis," Sacramento, California, May 29, 2014.

"Overview of Integrated Assessment," Snowmass Workshop on Climate Change Impacts and Integrated Assessment," Snowmass, Colorado, July 28, 2014.

"An IA Perspective on New Global Scenario Development," Snowmass Workshop on Climate Change Impacts and Integrated Assessment, Snowmass, Colorado, July 31, 2014.

"Climate Policy Scenarios; Past, Present and Future," Stanford Center at Peking University, Peking China, September 17, 2014.

"Overview of EMF 32 Study on US Power Plan and Revenue Recycling Climate Policies," Washington, D.C., October 22, 2014.

"Progress Report on the Development of the Integrated Assessment Modeling Consortium," seventh annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Hyattsville Maryland, November 17, 2014.

"Overview of EMF 30 Global Studies on Short Lived Climate Forcers and Bioenergy, Study on US Power Plan and Revenue Recycling Climate Policies," Hyattsville Maryland, November 19, 2014.

"Progress Report on the Work of the Precourt Energy Efficiency Center" sixth annual meeting of the Integrated Assessment Modeling Consortium (IAMC), Tsukuba, Japan, October 29, 2013.

"Contributions of Integrated Assessment and the Energy Modeling Forum," Center for Climate and Energy Decision Making, Department of Engineering and Public Policy
Carnegie Mellon University, December 1, 2014.

"The State of the Art in Integrated Climate Impacts Analysis," Snowmass Annual Meeting on Climate Change Impacts and Integrated Assessment, Snowmass Colorado, July 28, 2015.

"An Integrated Assessment Perspective on High Resolution Climate Projects for Stakeholder Climate Impact Analyses," Aspen Global Change Institute, August 1, 2015.

"The State of the Art in Integrated Assessment Modeling," Integrated Assessment Modeling Consortium Annual Meeting, Potsdam, Germany, November 16th, 2015.

"The State of the Art in Integrated Climate Impacts Analysis"
Snowmass Annual Meeting on Climate Change Impacts and Integrated Assessment, Snowmass Colorado, July 28, 2016.

"Advisory Committee Assessment of The European Advance Project on Improving Integrated Assessment" presentation to the European Commission, Brussels, October 7, 2016.

"Progress of the EMF 33 Project on Advanced Bio-Fuels and Climate Change Policy," Paris, April 24th, 2017.

"Advisory Committee Assessment of Progress of the European CD-LINKS Project on Climate and Development Linkages" CD-LINKS Project Annual Meeting, Potsdam, May 16, 2017.

"The State of the Art in Integrated Climate Impacts Analysis" Snowmass Annual Meeting on Climate Change Impacts and Integrated Assessment, Snowmass Colorado, July 19, 2017.

"Analysis and Modeling: What has analysis and modeling really taught us about deriving impact from technical innovation?" Workshop on Accelerating Climate-Mitigating Technology Development and Deployment, University of Maryland, College Park, June 6, 2018.

Appendix B

Appendix B
Documents Relied Upon by John P. Weyant

Pleadings

First Amended Complaint for Declaratory and Injunctive Relief, *Kelsey Cascadia Rose Juliana et al., Plaintiffs, v. The United States of America et al., Defendants*, September 10, 2015

Federal Defendants' Answer to First Amended Complaint for Declaratory and Injunctive Relief, *Kelsey Cascadia Rose Juliana et al., Plaintiffs, v. The United States of America et al., Defendants*, January 13, 2017

Expert Reports / Declarations

Expert Report of Frank Ackerman, April 13, 2018

Expert Report of Peter Ericson, April 12, 2018

Expert Report of James E. Hansen, Ph.D., April 13, 2018

Expert Report of Mark Jacobson, Ph.D., April 6, 2018

Expert Report of Steven W. Running, Ph.D., April 3, 2018 and associated supporting materials

Expert Report of Joseph E. Stiglitz, Ph.D., April 13, 2018

Expert Report of Kevin E. Trenberth, Sc.D., April 11, 2018 and associated supporting materials

Expert Report of James H. Williams, Ph.D., April 13, 2018

Books / Publications

Aspen Global Change Institute, workshop on Impact Relevance and Usability of High Resolution Climate Modeling and Datasets, https://www.agci.org/event/15s2, August 2-5, 2015, Aspen Colorado.

Biological and Environmental Research Advisory Council (BERAC), "Grand Challenges for Biological and Environmental Research: Progress and Future Vision; A Report from the Biological and Environmental Research Advisory Committee," DOE/SC–0190, BERAC Subcommittee on Grand Research Challenges for Biological and Environmental Research, 2017 (science.energy.gov/~/media/ber/berac/pdf/Reports/BERAC-2017-Grand-Challenges-Report.pdf).

Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change, Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change*, 1995.

Intergovernmental Panel on Climate Change, *Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change, Summary for Policymakers*, 1995.

Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report – Summary for Policymakers*, 2001.

Intergovernmental Panel on Climate Change, *Climate Change 2001: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers*, 2001.

Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report – Summary for Policymakers*, 2007.

Intergovernmental Panel on Climate Change, *Climate Change 2013: The Physical Science Basis – Evaluation of Climate Models, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 2013.

Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report*, 2014.

Intergovernmental Panel on Climate Change, *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers*, 2014.

National Academies of Sciences, Engineering, and Medicine, *Attribution of Extreme Weather Events in the Context of Climate Change*, 2016.

National Academies of Sciences, Engineering, and Medicine, *Review of the Draft Fourth National Climate Assessment*, 2018.

U.S. Global Change Research Program, *Climate Change Impacts in the United States: The Third National Climate Assessment*, 2014.

U.S. Global Change Research Program, *Climate Science Special Report: Fourth National Climate Assessment, Volume I*, 2017.

Academic Literature

Abatzoglou, J. T., & Williams, A. P. "Impact of anthropogenic climate change on wildfire across western US forests," *PNAS,* 2016, *113*(42), 11770-11775. doi:10.1073/pnas.1607171113

Balch, Jennifer et al., "Human-started Wildfires Expand the Fire Niche Across the United Stated," *PNAS*, 2017.

Luo, Lifeng et al., "Will Future Climate Favor More Erratic Wildfires in the Western United States?" Journal of Applied Meteorology and Climatology, 52(11), 2410-2417. doi:10.1175/jamc-d-12-0317.1

Jones, A., K. Calvin, and J.-F. Lamarque (2016). Climate modeling with decision makers in mind. Eos, 97, doi:10.1029/2016EO051111. Published on 27 April 2016. https://eos.org/meetingreports/climate-modeling-with-decision-makers-in-mind.

Mann, M. L., et al. "Incorporating Anthropogenic Influences into Fire Probability Models: Effects of Human Activity and Climate Change on Fire Activity in California," *Plos One*, 2017, *11*(4). doi:10.1371/journal.pone.0153589

Meinshausen, Malte, Sarah C.B. Raper, and Tom M.L. Wigley, "Emulating coupled atmosphere-ocean and carbon cycle models with a simpler model, MAGICC6–Part 1: Model description and calibration." Atmospheric Chemistry and Physics 11, no. 4 (2011): 1417-1456.

Syphard, A. D., et al. "Human presence diminishes the importance of climate in driving fire activity across the United States.," *PNAS,* 2017, *114*(52), 13750-13755. doi:10.1073/pnas.1713885114

Stephens, S. L., et al. "U.S. federal fire and forest policy: Emphasizing resilience in dry forests," *Ecosphere,* 2016, *7*(11). doi:10.1002/ecs2.1584

Trenberth, K., "Opinion: Super Storm Sandy," *The Scientist*, October 31, 2012, https://www.the-scientist.com/opinion/opinion-super-storm-sandy-40282

Trenberth, K., et al., "Attribution of climate extreme events," Nature Climate Change, Perspective, published online: June 22, 2015. doi: 10.1038/nclimate2657

Yoon, J. H., et al., "2015: Extreme fire season in California: A glimpse into the future?" [in "Explaining Extremes of 2014 from a Climate Perspective"]. *Bull. Amer. Meteor. Soc.*, 96 (12), S5–S9.

Public Press, Web Pages, and Other Publicly Available Materials

Alan Blinder & Christina Caron, "Seattle Chokes as Wildfire Smoke from Canada Blankets the Northwest," *New York Times*, August 7, 2017, at https://www.nytimes.com/2017/08/07/us/wildfires-canada-seattle.html.

Intergovernmental Panel on Climate Change, "IPPC Factsheet: What is the IPCC?", available at https://www.ipcc.ch/news_and_events/docs/factsheets/FS_what_ipcc.pdf

Oregon Department of Forestry, "About the Fire Program," https://www.oregon.gov/ODF/Fire/Pages/default.aspx

Oregon Department of Forestry, "Fire protection district maps," https://gisapps.odf.oregon.gov/ProtectionMapDownload/

Oregon Department of Forestry, "ODF Fire History 1911 –2017," https://www.oregon.gov/ODF/Documents/Fire/FireIntelGIS/20180305_ODF_CenturyFireHistory_11x17.pdf

Oregon Regional Economic Analysis Project, "Eugene MSA vs. Oregon, Comparative Trends Analysis: Population Growth and Change, 1969-2016," https://oregon.reaproject.org/analysis/comparative-trends-analysis/population/tools/78570000/410000/.

"Software Can Model How a Wildfire Will Spread, and Also How to Stop It Happening," *The Economist,* August 2, 2018, https://www.economist.com/science-and-technology/2018/08/02/software-can-model-how-a-wildfire-will-spread?cid1=cust/ddnew/email/n/n/2018082n/owned/n/n/ddnew/n/n/n/nna/Daily_Dispatch/email&etear=dailydispatch&utm_source=newsletter&utm_medium=email&utm_campaign=Daily_Dispatch&utm_term=2018082.

"The Carbon Cycle," http://wiki.magicc.org/index.php?title=The_Carbon_Cycle.

Jeffrey Kluger, "The Lessons from New York's Flooded Subways," *Time*, October 30, 2012, http://science.time.com/2012/10/30/the-lessons-from-new-yorks-flooded-subways/

UCAR Center for Science Education, "Climate Modeling," https://scied.ucar.edu/longcontent/climate-modeling

Data Sources

National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Global Monitoring Division, ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_gl.txt, accessed August 3, 2018

U.S. Energy Information Administration, International Energy Statistics

Software

Meinshausen, Malte, Sarah C.B. Raper, and Tom M.L. Wigley. MAGICC (version 6). Windows. 2011. (Model software and input data files.)

Any other documents or materials cited in this report.

Exhibit 1

Exhibit 1
Dr. Trenberth and Prof. Running's
Alleged Climate Change Impacts and Injuries to Plaintiffs

	Youth Plaintiffs Identified in the Complaint	Dr. Trenberth		Dr. Running	
		Alleged Climate Change Effect	Alleged Plaintiff Injury/Impact	Alleged Climate Change Effect	Alleged Plaintiff Injury/Impact
1	Aji P. West Seattle, Washington			Wildfires, Ecological Changes	Recreation, Air Quality
2	Alexander Loznak Kellogg, Oregon			Wildfires, Drought, Excessive Heat, Freshwater Degradation, Ecological Changes	Recreation, Air Quality, Economic Loss
3	Avery M. Eugene, Oregon			Wildfires, Excessive Heat, Ecological Changes, Freshwater Degradation	Recreation, Air Quality
4	Hazel V. Eugene, Oregon			Wildfires, Excessive Heat, Ecological Changes, Freshwater Degradation	Recreation, Air Quality
5	Isaac V. Beaverton, Oregon				
6	Jacob Lebel Roseburg, Oregon	Wildfires	Air Quality	Wildfires, Drought, Excessive Heat, Freshwater Degradation Ecological Changes	Recreation, Air Quality, Economic Loss
7	Jaime B. Flagstaff, Arizona	Drought, Wildfires, Excessive Heat	Water Quality & Scarcity	Wildfires, Excessive Heat, Ecological Changes	Recreation, Air Quality, Water Quality & Scarcity, Economic Loss
8	Jayden F. Rayne, Louisiana	Storms & Hurricanes	Economic Loss		
9	Journey Z. Kaua'i, Hawai'i	Storms & Hurricanes	Economic Loss, Safety		
10	Kelsey Cascadia Rose Juliana Eugene, Oregon			Wildfires, Ecological Changes	Recreation, Air Quality
11	Kiran Isaac Oommen Eugene, Oregon				
12	Levi D. Indialantic, Florida	Storms & Hurricanes, Coastal Erosion	Economic Loss, Recreation		
13	Miko V. Beaverton, Oregon				

Exhibit 1
Dr. Trenberth and Prof. Running's
Alleged Climate Change Impacts and Injuries to Plaintiffs

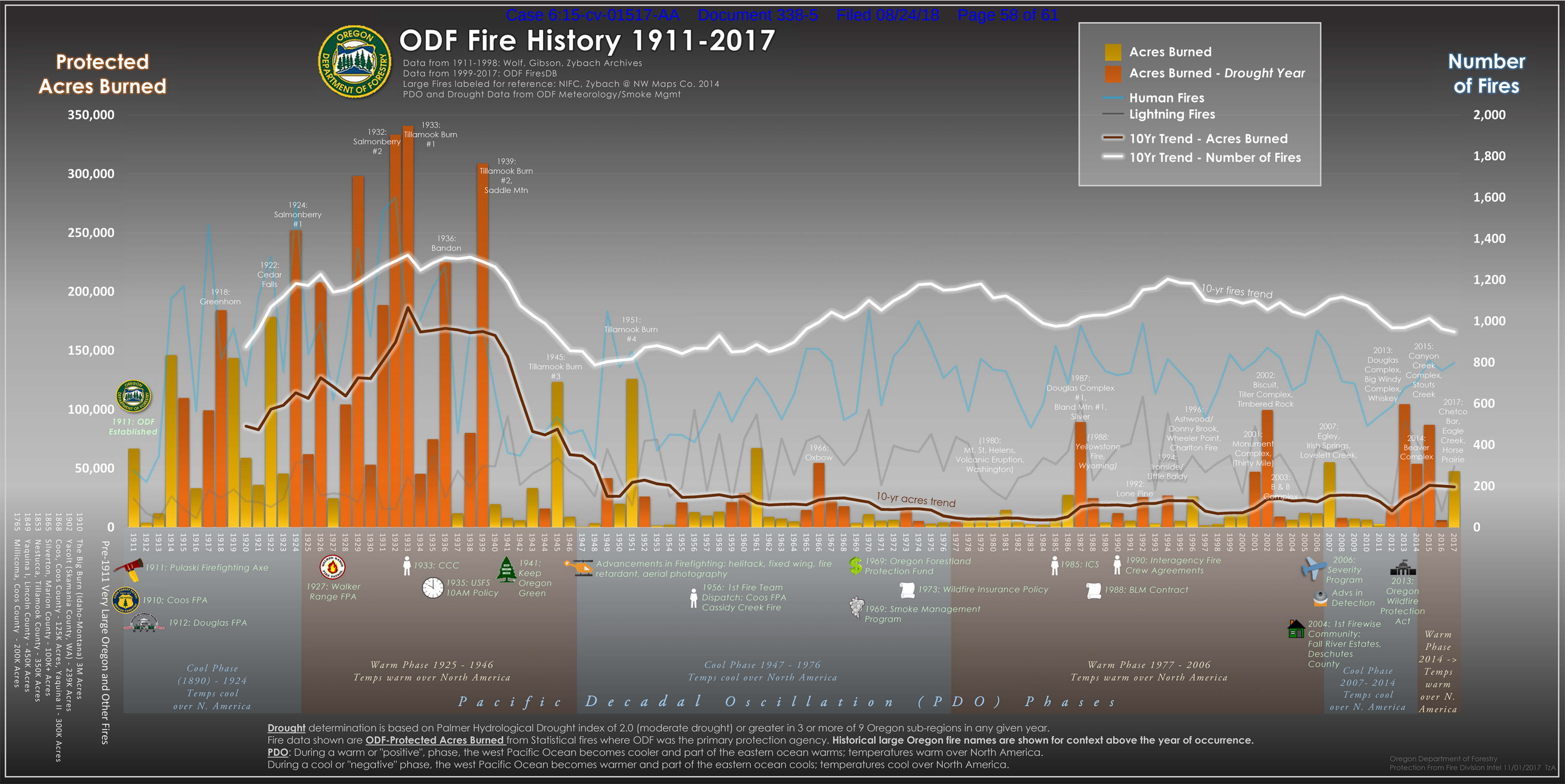
		Dr. Trenberth		Dr. Running	
	Youth Plaintiffs Identified in the Complaint	**Alleged Climate Change Effect**	**Alleged Plaintiff Injury/Impact**	**Alleged Climate Change Effect**	**Alleged Plaintiff Injury/Impact**
14	Nathaniel B. Fairbanks, Alaska	Wildfires, Excessive Heat	Economic Loss	Wildfires, Ecological Changes	Recreation, Air Quality
15	Nicholas V. Lakewood, Colorado			Wildfires, Ecological Changes	Recreation, Air Quality
16	Sahara V. Eugene, Oregon			Wildfires, Ecological Changes	Recreation, Air Quality
17	Sophie K. Allentown, Pennslyvania				
18	Tia Marie Hatton Bend, Oregon				
19	Victoria B. White Plains, New York	Storms & Hurricanes	Economic Loss, Safety		
20	Xiuhtezcatl Tonatiuh M. Boulder, Colorado	Storms & Hurricanes	Economic Loss	Wildfires, Ecological Changes	Recreation, Air Quality, Spiritual & Cultural Practice
21	Zealand B. Eugene, Oregon	Wildfires	Economic Loss	Wildfires, Ecological Changes	Recreation, Air Quality, Economic Loss

Source: Complaint, pp. 6-33; Trenberth Report, pp. 20-22; Running Report, pp. 6-17

Exhibit 2

ODF Fire History 1911-2017

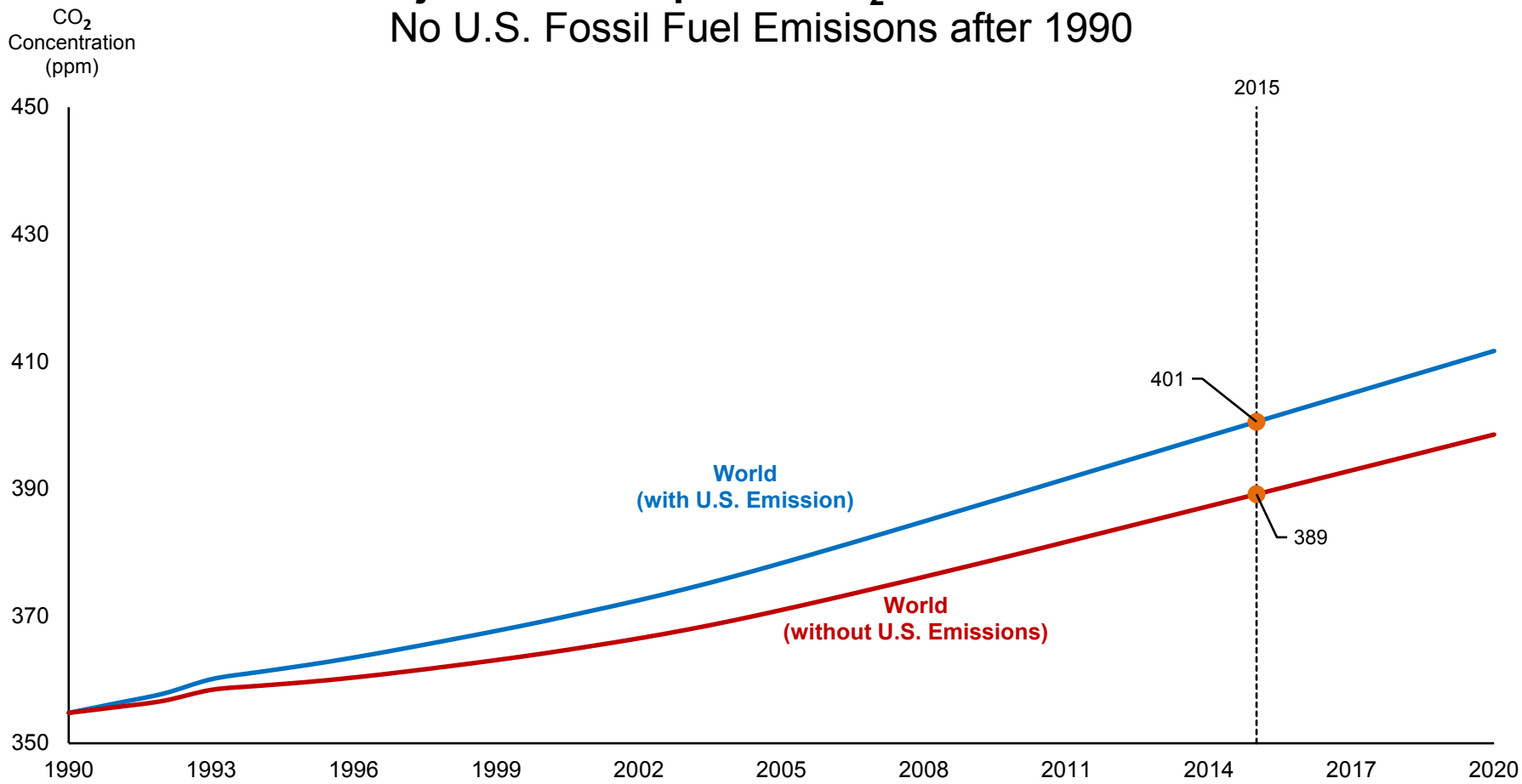
Data from 1911-1998: Wolf, Gibson, Zybach Archives
Data from 1999-2017: ODF FiresDB
Large Fires labeled for reference: NIFC, Zybach @ NW Maps Co. 2014
PDO and Drought Data from ODF Meteorology/Smoke Mgmt



Drought determination is based on Palmer Hydrological Drought index of 2.0 (moderate drought) or greater in 3 or more of 9 Oregon sub-regions in any given year.
Fire data shown are **ODF-Protected Acres Burned** from Statistical fires where ODF was the primary protection agency. **Historical large Oregon fire names are shown for context above the year of occurrence.**
PDO: During a warm or "positive", phase, the west Pacific Ocean becomes cooler and part of the eastern ocean warms; temperatures warm over North America.
During a cool or "negative" phase, the west Pacific Ocean becomes warmer and part of the eastern ocean cools; temperatures cool over North America.

Exhibit 3

Exhibit 3A
Projected Atmospheric CO_2 Concentration
No U.S. Fossil Fuel Emisisons after 1990



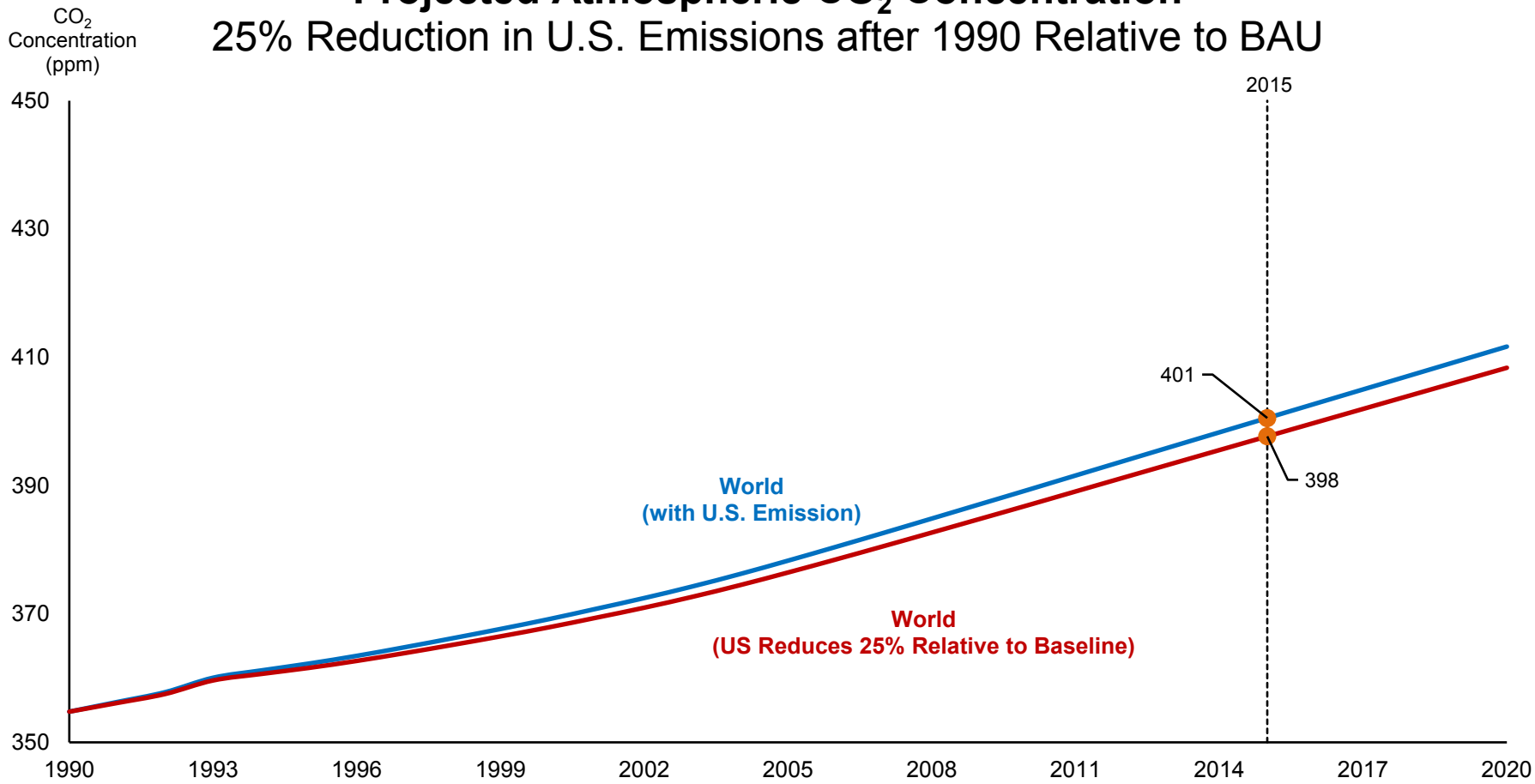
Source: Author's calculations using MAGICC6; U.S. Energy Information Administration ("EIA"), "International Energy Outlook 2017," September 2017; EIA, "Annual Energy Outlook 2017," January 2017; National Oceanic and Atmospheric Administration, Earth System Research Laboratory Global Monitoring Division.

Note:

[1] Projections are from the MAGICC6 model using the RCP45 concentration pathway as a baseline and historical concentration data through 1989. Actual CO_2 emissions from fossil fuels from 1990 – 2015 and projected emissions from 2015 – 2020 are subtracted from the baseline RCP45 emissions path to predict CO_2 concentration with no US Emissions. Actual U.S. emission data is from the EIA.

[2] In 2015, actual CO_2 Atmospheric Concentration was 399 ppm as measured by the Earth System Research Laboratory; Predictions from the model only use historical concentration data through 1989, which causes a deviation from the measured concentrations.

Exhibit 3B
Projected Atmospheric CO_2 Concentration
25% Reduction in U.S. Emissions after 1990 Relative to BAU



Source: Author's calculations using MAGICC6; U.S. Energy Information Administration ("EIA"), "International Energy Outlook 2017," September 2017; EIA, "Annual Energy Outlook 2017," January 2017; National Oceanic and Atmospheric Administration, Earth System Research Laboratory Global Monitoring Division.

Note:

[1] Projections are from the MAGICC6 model using the RCP45 concentration pathway as a baseline and historical concentration data through 1989. Actual CO_2 emissions from fossil fuels from 1990 – 2015 and projected emissions from 2015 – 2020 are multiplied by .25 and subtracted from the baseline RCP45 emissions path to predict CO_2 concentration with a 25% reduction in U.S. emissions. Actual U.S. emission data is from the EIA.

[2] In 2015, actual CO_2 Atmospheric Concentration was 399 ppm as measured by the Earth System Research Laboratory; Predictions from the model only use historical concentration data through 1989, which causes a deviation from the measured concentrations.